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HOW DOES A PROGRAM MANAGER MAKE SENSE OF THE ACQUISITION PROGRAM'S ENVIRONMENT TO PREVENT PROBLEMS FROM INSTIGATING FAILURE? AN ANALYSIS OF INPUTS AND PROCESSES USED TO MAKE INFORMATIVE DECISIONS

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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

JOINT APPLIED PROJECT REPORT

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June 2021

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LIST OF ACRONYMS AND ABBREVIATIONS

ACAT	Acquisition Category
DFARS	Defense Acquisition Regulation Supplement
DOD	Department of Defense
FAR	Federal Acquisition Regulations
GAO	Government Accountability Office
JCIDS	Joint Capabilities Integration and Development System
JPEO	Joint Program Executive Office
JTRS	Joint Tactical Radio System
MBA	Master of Business Administration
MDAPs	Major Defense Acquisition Programs
NDAA	National Defense Authorization Act
NDIA	National Defense Industrial Association
NDM	Natural Decision Making
RPD	Recognition-Primed Decision

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I. INTRODUCTION

The Department of Defense (DOD) is responsible for sustaining "the military forces needed to deter war and ensure our nation's security" (U.S. DOD, n.d., "About"). To uphold this mission, the DOD maintains a Fiscal Year 2020 portfolio of 121 acquisition programs valued at over $1.8 trillion (Oakley, 2020, p. 1). The DOD defines an acquisition program as "directed and funded efforts designed to provide a new, improved, or continuing material, weapon or information system, or services capability in response to an approved need" (Brown, 2010, p. 2). To support the DOD's efforts in delivering a necessary capability solution to the warfighter, the Defense Acquisition System establishes the management framework a program manager uses to organize, plan, and execute an acquisition program (Brown, 2010). The Defense Acquisition System provides the program manager with the information necessary to make informed decisions on allocating scarce resources best to ensure acquisition program requirements are met (Brown, 2010).

Program managers are the keystone to an acquisition program's success. Under the Defense Acquisition System, according to Cooley and Ruhm (2014), "program managers must employ tools to manage a program's complexity, ensure efficient use of resources, assess program progress, and apply professional judgment and experience when issues arise that threaten a program or hinder progress" (p. 12). Variables—such as funding, requirements, time, adversary threat, technology—are the nonlinear factors that create a program's environment. The interaction of these factors during the acquisition process also creates complexity in the program's environment. Figure 1 illustrates a few of the variables a program manager must manage together with their interrelationships (Brown, 2010).

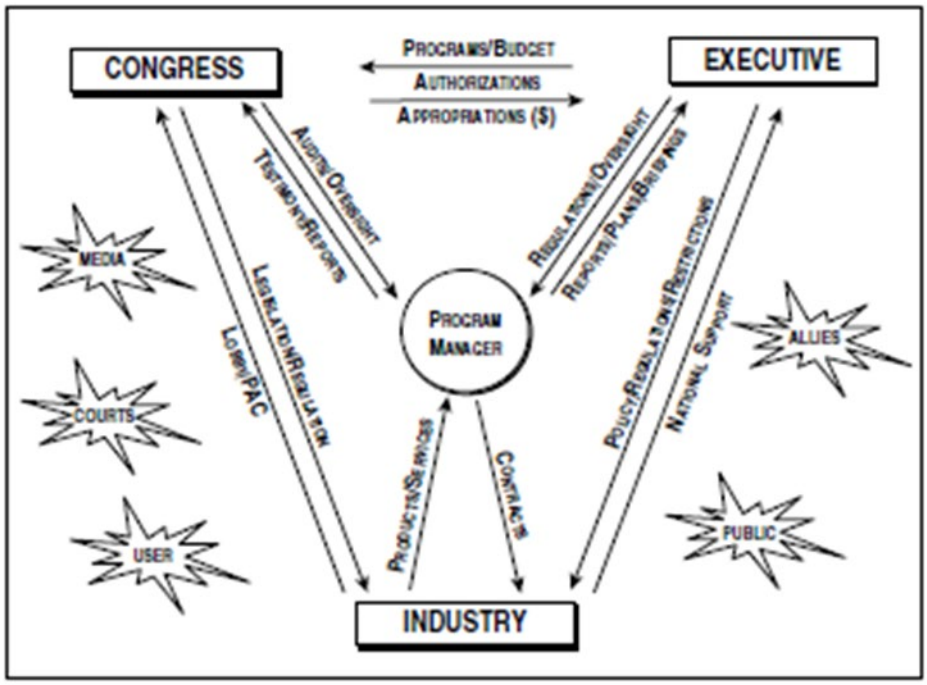

Figure 1. The Program Manager's Environment. Source: Brown (2010).

As an acquisition program progresses through the Defense Acquisition System, the variables that make up the acquisition program's environment increases. The program manager's challenge is to simultaneously manage all of these variables while solving any problems that may impede the acquisition program's success. Failure to so contributes to a lack of understanding of the program's environment and magnifies the problems a program manager experiences, which may lead to program failure. Due to the multifaceted considerations of managing an acquisition program through the Defense Acquisition System, there becomes a greater need for the program manager to adapt to changes in the acquisition program's environment by looking for simple solutions that meet program requirements and avoiding situations that impede success. However, the DOD's traditional solution to uncomplicating program complexity has been to apply control-oriented techniques that emphasize compliance and standardization in how the DOD program managers execute an acquisition program through the Defense Acquisition System. These control-oriented techniques—such as regulations, policy, procedure, acquisition oversight and authority—are the linear factors that occur in every program.

With little research on the correlation between acquisition program complexity and acquisition program results, as stated in Haas and Lindbergh (2010), "it is clear that [the DOD's acquisition programs] are becoming more complex and that complexity matters" ("Conclusion—Complexity Matters"). Complexity is difficult to define because it is situational. Often, program complexity is recognized in a general way and not entirely understood by everyone. This research defines program management complexity as managing a DOD acquisition program with the following characteristics as described by Haas and Lindbergh,

1. Are characterized by uncertainty, ambiguity, dynamic interfaces, and significant political or external influences; and/or
2. Usually run over a period which exceeds the technology cycle time of the technologies involved; and/or
3. Can be defined by effect, but not by solution. (Haas & Lindbergh, 2010)

To better understand why the DOD's acquisition program's environment is so complex, we must first examine how the DOD's acquisition program environment became this complex.

A. BACKGROUND

According to Evelyn Layton (2007), "during World War II and into the Cold War, a fundamental change in the nature of weapons emerged. The government could no longer rely on its arsenals and shipyards to meet the needs of the warfighter because the implements of war were no longer simply weapons; they had become complex weapon systems" (p. 5). The DOD needed the knowledge, skills, and technical support from the private industry to maintain a competitive advantage and began outsourcing capability development to private industry, which redefined the relationship between government and industry (Layton, 2007). Over time, as the DOD grew increasingly reliant on outsourcing capability development to private industry, the DOD's acquisition programs also started to experience higher fraud, waste, and abuse (Layton, 2007). Program managers started to see acquisition costs rise steeply, schedules begin to slip, and delivered systems did not perform as anticipated (Layton, 2007). Poor acquisition outcomes jeopardized the DOD's

operational effectiveness and technological superiority, and thus endangered the DOD's mission.

Determined to reduce fraud, waste, and abuse and improve program outcomes, Congress has since passed many acquisition reform initiatives. In the 1980s, cost overruns led President Ronald Reagan to establish the Packard Commission in 1986 to study the acquisition process and identify efficiencies with associated cost savings (Christensen et al., 1999). In 1986, poor acquisition outcomes led Congress to pass the Goldwater-Nichols Act to promote jointness within the DOD's acquisition process (McInnis, 2016). In 1994, Congress issued the Federal Acquisition Streamlining Act based on a study sponsored by the U.S. Army Material Command that found the DOD's unique requirements added approximately a 20 percent premium to contractor proposals (Barry, 1995). In 1997, the Defense Reform Initiative released the DOD's plan to become more agile and responsive (Warren, 1999, p. 12). In 2009, Congress passed the Weapons System Acquisition Reform Act to improve the way weapon systems were acquired by strengthening oversight and accountability in early program decision-making (Sullivan, 2012). Starting in 2010 with two subsequent releases in 2012 and 2015, the DOD released the Better Buying Power initiatives. The intent of the Better Buying Power initiatives, according to the DOD (n.d.), was "to strengthen the Defense Department's buying power, improve industry productivity and provide an affordable, value-added military capability to the warfighter" ("What is Better Buying Power?"). In 2016, the National Defense Authorization Act (NDAA) passed into law an acquisition reform provision that creates new oversight processes of major defense acquisition programs (National Defense Industrial Association [NDIA], 2019, para. 2). In 2017, the NDAA specified two additional oversight processes to the acquisition process. The two reform provisions included in the 2017 NDAA were "consideration of cost, fielding, and performance goals before funds are invested in acquisition programs, [and] the assessment of technical risk throughout the acquisition process" (NDIA, 2019, para. 3). Today, additional reform efforts to identify barriers, streamline acquisition oversight, and improve the acquisition process to deliver capabilities faster continue to be considered. However, only so much reforming of the acquisition process can occur to "fix"

the challenges a program manager experiences when managing an acquisition program through the Defense Acquisition System.

B. PROBLEM STATEMENT

Despite the numerous studies and reform efforts to correct deficiencies, the DOD's acquisition programs continue to take longer to deliver, cost more than the initial budget, and underperform with less capability than expected when measured against their initial program baseline. According to Oakley (2020), between 2018 and 2019, "total acquisition cost estimates for the 85 Major Defense Acquisition Programs (MDAPs) in the DOD's 2019 portfolio increased by a combined $64 billion (a 4 percent increase), while capability delivery schedules increased, on average, by just over one month (a 1 percent increase)" (p. 24). Oakley (2020) also reports that since the DOD's initial estimate of total acquisition cost for their 85 Major Defense Acquisition Programs (MDAPs), "these 85 MDAPs have accumulated over $628 billion (or 54 percent) in total cost growth, and schedule growth has increased by 29 percent, resulting in an average capability delivery delay of more than two years" (p. 24). Table 1 details changes in the three cost estimates that make up the total estimated acquisition cost since the first complete estimate of the DOD's 85 MDAPs.

Table 1. Cost Changes to DOD's 2019 Portfolio of 85 Major Defense Acquisition Programs since First Full Estimates (Fiscal Year 2020 Dollars in Billions). Source: Oakley (2020).

	Estimated portfolio cost at first full estimates	Estimated portfolio cost in 2019	Estimated portfolio change since first full estimates	Percentage change since first full estimates
Total estimated research and development cost	209.90	332.08	122.18	58.2
Total estimated procurement cost	943.83	1445.56	501.73	53.2
Total estimated other acquisition cost[a]	12.94	17.37	4.43	34.2
Total estimated acquisition cost	1166.67	1795.01	628.34	53.9

While efforts continue to take a broad approach at reforming the DOD's acquisition process by focusing on competition, contract types, process, policy, and procedure, Fox (2011) observes that "it is increasingly evident that barriers to improving derive not from a lack of ideas" (p. xii). In agreeing with Fox's (2011) outlook, "there seems to be little

hope of solving the chronic problems if the usual attempts at reform are tried once again" (p. xiii). For the DOD to positively influence acquisition program outcomes, reform efforts need to focus on how a program manager's decisions influence the acquisition program's environment. An acquisition program's success depends on the program manager acquiring a sense of understanding of the uncertain program environment and correlating that understanding with decisions that lead to program success. The unpredictable events a program manager experiences in the program's environment are the nonlinear factors on which a program manager's managing process is dependent, and according to Jones (2017), "may have similarities and patterns that can be studied with regard to their association with the individuals involved in the decision-making process" (p. 36).

C. PURPOSE

This Joint Applied Project is part of a more prominent research topic sponsored by Raymond Jones (2020) under the Acquisition Research Program at the Graduate School of Defense at the Naval Postgraduate School. As a result, we know there are overlaps with other similar master's theses, MBA Professional Projects, and Joint Applied Projects sponsored by Jones under this Acquisition Research Program topic at the Graduate School of Defense at the Naval Postgraduate School (e.g., Baker & Benjamin, 2018; Donahue et al., 2018; Holcomb & Rumfelt, 2018; Neterer & Patrone, 2018) where the same or similar research questions, methodology, and coding systems occur. The purpose of this research topic, according to Jones (2020), is to "focus on how the program manager gains insight in the decision-making process and correlate this with overall program performance" (p. 16). This particular project studies three DOD program managers. This research examines each program manager's decision-making framework when formulating decisions to make day-to-day decisions driven by experiencing unpredictable events in the program's environment. This research also examines the inputs and reasoning used in formulating those decisions for similarities and patterns, draws conclusions on how these three DOD program managers make decisions, and makes recommendations for future projects under this research topic. By better understanding how program managers influence acquisition program outcomes through decision-making, perhaps future acquisition reform efforts can be better tailored to the DOD's acquisition program environment.

D. SCOPE

In following Jones' (2017) Acquisition Research Symposium report, and also used in similar master's theses, MBA Professional Projects, and Joint Applied Projects sponsored by Jones under this Acquisition Research Program topic at the Graduate School of Defense at the Naval Postgraduate School (e.g., Baker & Benjamin, 2018; Donahue et al., 2018; Holcomb & Rumfelt, 2018; Neterer & Patrone, 2018), this study uses qualitative research in the form of ethnographic interviewing for gathering information. Ethnographic interviewing focuses on observing human behavior for "gather [ing] non-numeric data [to] generate a theory to support such data" (Baker & Benjamin, 2018). This study uses the qualitative data to reach our end-state by weaving in research subjects' personal experiences to explore the hypothesis of how a program manager thinks and makes decisions. Chapter II provides a literature review of decision-making frameworks, processes, and models relevant to this research to help make sense of the cognitive processes and factors that influence decision-making. This research emphasizes the modified grounded theory of decision-making. Chapter III discusses this research's methodology to understand better the data presented in Chapter IV. Chapter IV reveals the results of each team member's coding and categorization of analyzed transcribed interview data using grounded theory's constant comparative methods articulated by Glaser and Strauss (1967). Chapter V reveals a comparative analysis of all three project team member's codes and categories. Chapter VI draws conclusions "on how the program manager gains insight in the decision making process" (Jones, 2020, Topic No. T17-019), and makes decisions and makes future research recommendations.

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II. LITERATURE REVIEW

Decision-making is one of the most prominent topics of study in social science. Although decision-making is a broad and complex concept, there is a certain degree of consistency amongst researchers on the basic definition of decision-making. Decision-making is the process used to decide on something. Decision-making becomes even more challenging when there are many stakeholders involved, and success depends on corrective decision-making. The right decisions may bring success, while a wrong or untimely decision may end in failure. The success of a Program of Record is dependent on a program manager's ability to understand and influence the program environment and make effective decisions in the program's best interest. This chapter provides a literature review of the different frameworks and processes associated with this research and finalizes with models used by the research subjects.

A. SENSEMAKING

Program managers bear the burden of formulating, guiding, organizing, managing the program, and coordinating the response to changes in the program's environment. Program managers need to detect an environmental change that could potentially bring about failure to the program. Detecting change in a timely manner is vital to a program's success. Aguilar (1967), as cited in Kauer (2008), stresses that "the need for [program managers] to foresee and understand changes in the environment has become increasingly important" (p. 2). Changes in the environment prompt the need for sensemaking.

According to Ancona (2011), "sensemaking, a term introduced by Karl Weick, refers to how we structure the unknown to be able to act in it" (p. 1). When a decision-maker senses changes in the environment, their beliefs shape what they see and give form to their choice of actions that follow.

In a 2013 *The Qualitative Report* journal article, Megan Paull et al. state that when a program manager is "organizing their understanding of what is happening, individuals create plausible, but not necessarily correct explanations which lead to action" (p. 2). The authors also explain that a heightened level of conscious sensemaking occurs when a

program manager notices an unexpected change in the environment and interprets the change as a cue to determine why it happened (Paull et al., 2013).

Sensemaking is vital because it allows the program manager to understand what is going on in the program's environment. It is the analytical tool used when analyzing the program manager's interview response in this research. In this study, sensemaking means learning about shifting politics, changing laws, new technologies, and how the program manager approached the situation.

B. THE CYNEFIN FRAMEWORK

A Cynefin framework is a decision-making tool introduced by David Snowden in 1999 that aids the sensemaking process and helps program managers dealing with complex program environments to identify the problem source and tailor their actions accordingly effectively. "Cynefin" is a Welsh word and pronounced "Ku-nev-in," and the English translation is habitat or place (Snowden & Boone, 2007). Figure 2 illustrates the five situational elements of the Cynefin framework, which defines the issues a program manager faces into cause-and-effect relationships (Snowden & Boone, 2007).

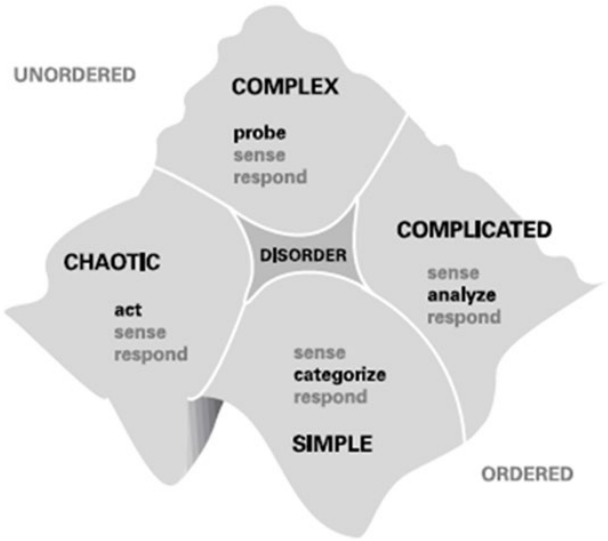

Figure 2. Cynefin Framework. Source: Snowden and Boone (2007).

In their *Harvard Business Review* article, Snowden and Boone (2007) recommend that program managers use the Cynefin Framework to help "sense which context they are

in so that they can not only make better decisions but also avoid the problems that arise when their preferred management style causes them to make mistakes" (para. 6). The Cynefin Framework is comprised of five domains. According to Snowden and Boone, "four of these—simple, complicated, complex, and chaotic—require [program managers] to diagnose situations and to act in contextually appropriate ways" (para. 5). Snowden and Boone also state, "the fifth [context]—disorder—applies when it is unclear which of the other four contexts is predominant" (para. 5). The following paragraphs highlight the five domains.

1. Simple Context (The Domain of Best Practice)

Under the Simple Context, the cause-and-effect relationship is easily identifiable, and "the right answer is self-evident and undisputed" (Snowden & Boone, 2007, para. 7). For the simple domain, the decision model is to sense, categorize, and respond, and the appropriate response is to apply best practice (Snowden & Boone, 2007). With the simple context scenario, a program manager can assess the facts, categorize the situation, and respond quickly based on established practice. An example of this domain in the acquisition process includes heavily administrative functions such as contract solicitation or invoice certification. There are clear applicable regulations and clauses that the decision-maker can quickly evaluate to decide. The solicitations and invoice certification processes are readily available, rendering this scenario easily delegated to lower decision-makers; one can follow a current process or procedure in place, and the program should function without problems.

As Snowden and Boone identify, problems can occur when issues are misclassified in the simple domain because of oversimplification, program managers not considering a new solution, and complacency. Oversimplification results from program managers seeking the most abbreviated information without regard for the complexity, ultimately running the risk of missing important information (Snowden & Boone, 2007). According to Snowden and Boone (2007), program managers miss opportunities for new solutions when their responses are pre-conditioned. Lastly, when programs appear to be running efficiently, program managers can become complacent and miss the sudden change in the

program environment and react too late (Snowden & Boone, 2007). Complacency is particularly dangerous because shifts from the simple domain could quickly end up in the chaotic; as shown in Figure 2, the chaotic domain is next to the simple domain. Napster's effect on the CD market and iPhone in the smartphone industry are historical examples of a shift from the simple domain that failed due to a delayed reaction.

2. Complicated Domain (The Domain of Experts)

The next domain described by Snowden and Boone (2007) is the Complicated Domain. It is different because the cause-and-effect relationship is difficult to identify, and there may be multiple correct answers. Snowden and Boone state that in the complicated domain, the decision model is to "sense, analyze, and respond" (para. 13). The appropriate response is to apply good or best practice (Snowden & Boone, 2007). Snowden and Boone refer to this domain as The Domain of Experts due to the complex nature and analysis requirement, which often requires someone with expertise to make the right decision. The defense acquisition system is an excellent example of the complicated domain with its multiple complex layers. Because of this, the government requires certain levels of expertise, such as Defense Acquisition Workforce Improvement Act Level III or Federal Acquisition Certification in Contracting for its management-level workforce. To allow a workforce of decision-makers without this expertise, the government would be subject to making a poor business decision and buying the wrong product or material, ultimately putting the warfighter at risk.

3. Complex Domain (The Domain of Emergence)

The Complex Domain does not show its cause-and-effect relationship until later in the scenario, often after the decision and response (Snowden & Boone, 2007). The complex domain potentially has multiple right answers, and the decision model is to probe, sense, and respond (Snowden & Boone, 2007). The probing aspect is to conduct experiments in an effort to sense if the direction of the scenario is going to be acceptable or not. Snowden and Boone refer to this as The Domain of Emergence, because the result often "emerges" from the probing, a new way of doing things.

4. Chaotic Domain (The Domain of Rapid Response)

There is no correct answer in the Chaotic Domain, and the cause-and-effect relationship is indeterminate (Snowden & Boone, 2007). A prime example of this scenario is the COVID-19 pandemic. The world was not prepared and is still searching for methods of response. The chaotic domain decision model is to act (establish order) and sense for stability and respond because the main goal here is to "stop the chaos" by stabilizing the situation (Snowden & Boone, 2007). Program management in the chaotic environment demands decisive action and issuing directives to establish order. Snowden and Boone refer to this as The Domain of Rapid Response.

5. Disorder Domain

Snowden and Boone state that the Disorder Domain applies when the program manager is not sure if any other domains apply (2007). The most appropriate response is to "break down the situation into its constituent parts and assign each to one of the other four realms" (Snowden & Boone, 2007, para. 7).

The decision-maker's actions are dependent on the domain that the situation applies. Utilizing the Cynefin Framework, program managers can quickly assess the situation and respond expediently and more appropriately. The Cynefin Framework will also help the decision-maker identify when a new or different response to the situation is necessary and encourage flexibility in decision-making and adapting their management style to different circumstances.

C. DUAL-PROCESS THEORY

The dual-process theory supposes that decision-making is two separate cognitive processes, also known as System 1 and System 2 thinking. Theorist Daniel Kahneman (2003) states, "System 1 operations are intuitive, spontaneous and emotionally charged; whereas System 2 operations are dependent on cognitive thought and are deliberately controlled" (p. 698). Figure 3 highlights the dual-process theory and the operating characteristics of System 1 and System 2.

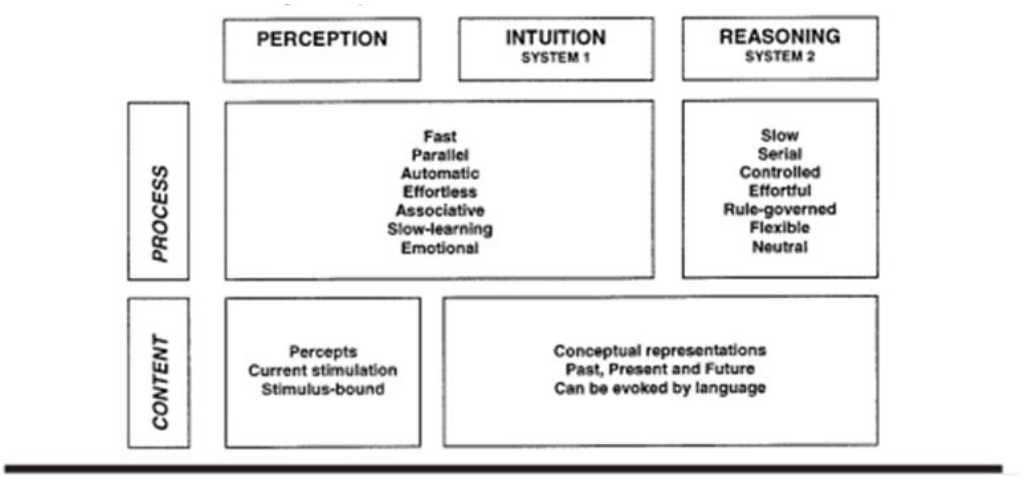

Figure 3. Process and Context in Two Cognitive Systems.
Source: Kahneman (2003).

When deciding, how does a program manager know when to trust their intuition as opposed to rationalization? Research on dual-process theory suggests that, according to Kahneman (2012), "most of what you (your System 2) think and do originates in your System 1, but System 2 takes over when things get difficult, and normally has the last word" (para. 19). James Aung and Alex Norman (n.d.) further explain, "System 1 (intuition) is more accurate in areas where we have gathered much data with reliable and fast feedback; whereas our System 2 tends to be better for decisions where we do not have much experience" (para. 2). For example, two programs have experienced unexpected slippage in their timeline, and now the program manager for each program is responsible for accelerating the schedule. Upon finding out, the first program manager (with twenty years of experience) instantly decides to tailor the acquisition process. The second program manager (with only two years of experience) has to look at the program's critical path and compare it to the acquisition process to determine how much time each task is adding to the schedule, and then has to determine how important a task is to the acquisition process before making a decision. Due to having made the same or similar decisions in the past and having acquired enough data with reliable feedback from those experiences, the first program manager could rely on intuition to make a faster decision. The second program manager with less experience had to rely on reasoning and weigh all the relevant factors due to not having enough data with reliable feedback to make a decision.

According to Hollingworth and Barker (2019), the intent of the dual-process theory is "intended to be a helpful analogy to guide our understanding of how our minds process information" (para. 6). By understanding System 1 and System 2 thinking, we as researchers have a better understanding of the cognitive processes a program manager uses based on the types of information the program manager relied upon to make a decision.

D. INTUITIVE DECISION STRATEGY

Every day a program manager relies on impressions, intuitions, intentions, and feelings generated under System 1 thinking to make decisions. System 1 thinking allows a program manager to make faster decisions that are often sufficient, and somehow more often than not, end up being the right decision. According to Matzler et al. (2007), "for many complex decisions, all the data in the world cannot trump the lifetime's worth of experience that informs one's gut feeling, instinct, or intuition" (p. 13). The authors define intuition as "a highly complex and highly developed form of reasoning that is based on years of experience and learning, and on facts, patterns, concepts, procedures, and abstractions stored in one's head" (p. 14). Therefore, according to Matzler et al. (2007), "the more extensive a decision-maker's experience, the more patterns he or she will be familiar with; the more patterns, the better the intuition" (p. 14). When a decision-maker says that they have a gut reaction to a decision, what they are saying is that they have experience with the situation and recognize a pattern they have seen before.

According to Matzler et al. (2007), intuitive decision-making is a process that often happens unconsciously and is essential when decisions are complex. As they explain, "complex decisions bring into play a process in which knowledge, experience, and emotions are linked, and this process is what people commonly think of when they hear the word 'intuition'" (p. 14). Matzler et al. (2007) go on to further explain that "research has found that people who have acquired deep wells of knowledge and experience—through their curiosity, openness, and propensity to seize opportunities—are able to reach good 'intuitive' decisions much more frequently than people who possess a relatively limited sphere of experience," (p. 14). Although decisions based on System 1 thinking are usually right, this does not guarantee it was the best decision.

The knowledge, experience, and emotions under System 1 thinking do not always lead to a good decision because there is often an implication of uncertainty, which stems from the speed of the decision made. Under System 1 thinking, decisions are fast, because decision-making input is limited to only what the decision-maker knows, due to additional information not gathered increasing the likelihood of missed information. Some decision-makers will display (intentional or unintentional) confirmation bias. Confirmation bias, according to Nickerson (1998), "connotes the seeking or interpreting of evidence in ways that are partial to existing beliefs, expectations, or a hypothesis in hand" (p. 175). In citing Evans' data, Nickerson (1998) explains, "confirmation bias is perhaps the best known and most widely accepted notion of the inferential error to come out of the literature on human reasoning" (p. 175). Table 2 shows common thinking biases and their distortion of reasoning.

Table 2. Biases When Making Decisions. Source: Wolf (2012).

Decision Bias	Distortion
Anchoring	• We tend to be influenced by numbers, even invalid ones and we don't adjust away from them as we should • Numbers affect our decisions, even when we should ignore them • Our questions prime our attention for certain information, ignoring or omitting contradictory data
Framing	• How a situation is presented to you affects your decision. *Generally, our pain of losing is more powerful than our pleasure of winning, hence we really are risk averse to gains and risk seeking to avoid further loss*
Availability heuristic	• Vivid, easily imagined, but uncommon events are highly weighted in our brains • Recent events get weighted disproportionately higher than past events
Confirmation Bias	• Our initial decisions become self-fulfilling prophesies. *We seek out evidence that confirms our initial decisions, ignoring information against them*
Commitment escalation	• Making decisions and committing resources doesn't necessarily guarantee a reward, and my produce a loss • It's difficult to accept sunk costs
Hindsight bias	• Once we know something, we can't remember when we did not know it • This challenges our ability to learn from past failures

Decision-making biases are mistakes in reasoning made during the decision-making process. Due to personal preferences and beliefs, decision biases weaken the relevance and reliability of any decision-making strategy. Nickerson (1998) explains that "people have a tendency to gather information in support or opposition to only one hypothesis at a time; this tendency attributes to the confirmation bias" (p.198). In citing Frey, Nickerson (1986) further explains that "people also can increase the likelihood of getting information that is consistent with existing beliefs and decrease the likelihood of getting information that is inconsistent with them by being selective with respect to where they get information" (p. 198–199). According to Wolf (2012), "We must challenge our decision-making process by realizing that we both influence and are influenced by the format of the information" (para. 5). Therefore, minimizing the impact of decision-making bias throughout the decision-making process is essential (Wolf, 2012).

Intuitiveness as a decision-making strategy is vital to this research because it provides insight into how a program manager can make fast decisions in a complex program environment. It is essential to recognize when an intuitive decision strategy identifies the knowledge, experience, and emotions used as decision-making input when specific patterns in the environment exist. It is also essential to consider how the program manager's experiences, emotional vulnerabilities and biases may have affected personal judgement and how decisions improve the quality of future decision-making.

E. NATURALISTIC DECISION-MAKING

Naturalistic Decision-Making (NDM) is a decision-making framework emerging from a field of study on decision-making in the late 1980s (Klein, 2008). Before NDM, studies on decision-making found that most decision-makers did not use a systematic process to evaluate decisions (Klein, 2008). These results led researchers to shift the focus of their study on decision-making to start looking at, according to Klein (2008), "how [knowledgeable and experienced] decision-makers were able to make tough decisions under difficult conditions such as limited time, uncertainty, high stakes, vague goals, and unstable conditions" (p. 456). NDM studies suggest that instead of comparing options to make a decision, according to Klein (2015), "decision-makers in natural settings rely

heavily on intuition" (p. 164). As a result, NDM studies continue to search for ways to strengthen intuition in decision-making (Klein, 2015).

In citing Klein and Klein et al., Klein (2015) states, "The NDM community views intuition as an expression of experience as people build up patterns that enable them to rapidly size up situations and make rapid decisions without having to compare options" (p. 164). The following eight factors characterize NDM's conditions, but, and according to Klein et al. (1993), "It [is] not likely that all eight factors will be at their most difficult levels in any one setting, but often several of these factors will complicate the decision task" (p. 7).

1. Ill-structured problems: The program environment is not orderly, with all boundaries well defined; when issues arise, the program manager will have to do the detective work to figure out what task(s) must be complete to remedy the issue. In the naturalistic setting, ill-structured problems have multiple solutions, no standardized problem-solving process, and the solution may need to be invented (Klein et al., 1993).

2. Uncertain dynamic environments: Program management occurs in an imperfect world where the only sure thing is uncertainty. In addition to making decisions with imperfect information, two additional factors exist within the naturalistic environment that make completing tasks more challenging; "First, the task is likely to be dynamic—the environment may change quickly, within the time frame of the required decision. Second, the validity of the information may be suspect if it is generated by an intelligent adversary" (Klein et. al., 1993, p. 8).

3. Shifting, ill-defined, or competing goals: During the management of a Program of Record, a program manager may have to satisfy more than one goal or purpose through tradeoffs in cost, schedule, or performance. In the naturalistic environment, it is rare for well-understood goals or values to drive the decisions made (Klein et al., 1993). According to Klein et al.

(1993), conflicts and tradeoffs are tricky because they tend to be unusual and need quick resolution due to the quickly changing situation.

4. Action/feedback loops: In the acquisition process there are multiple testing events and milestones before a product is completed and delivered to the warfighter. Each testing and milestone event provide an opportunity for the program manager to gather new information about issues in need of corrective action. Unlike the traditional decision models, the naturalistic environment will have multiple events or a string of actions over time that are intended to evaluate and address the problem, giving the decision-maker multiple opportunities for corrective action (Klein et al., 1993).

5. Time stress: In the defense acquisition process, program managers make decisions under significant time pressure. The time stress factor in the naturalistic environment has several implications: the high level of stress for decision-makers and the decision-makers' thinking will shift toward using less complicated reasoning strategies (Klein et al., 1993, p. 9).

6. High stakes: Risk is always a factor in a program manager's decision making for two reasons; first, the decisions made might be about a gravely needed capability; second, advancement comes to program managers who make the right decisions and not to those who do not make good decisions. Under the naturalistic environment, when a program manager cares about the outcome of a decision, the decision will induce stress but motivate the program manager to take an active role in arriving at a good outcome (Klein et al., 1993).

7. Multiple players: Under the Acquisition process, many stakeholders are involved in the decision-making process. For example, the program manager has Title 10 authority over the program, but must also report to the Program Executive Officer, who reports to the Service Acquisition Executive, who reports to the Secretary of the Army, who reports to the Secretary of Defense, and so on. Occasionally, Congress will intervene if

constituents are unhappy. In the naturalistic environment, Klein et al. state that it is hard to get a consensus with all team members regarding understanding of goals and situational status in order to focus on relevant information when making decisions (Klein et al., 1993).

8. Organizational goals and norms: In the naturalistic environment, an organization's goals and norms are essential to the decision-making process in two ways. According to Klein et al. (1993), "first, the values and goals that are being applied will not merely be simply the personal preferences of the individuals involved. Second, the organization may respond to the decision maker's various difficulties by establishing more general goals, rules, standard operating procedures, 'service doctrine,' or similar guidelines" (p. 10).

F. RECOGNITION PRIMED DECISION-MAKING MODEL

The Recognition-Primed Decision (RPD) model is the primary model derived from the NDM framework. As cited by Klein et al., Klein (2008) states, "the RPD model describes how [program managers] use their experience in the form of a repertoire of patterns" (p. 457). According to Klein, "patterns highlight the most relevant cues, provide expectancies, identify plausible goals, and suggest typical types of reactions in that type of situation" (p. 457). When making decisions, program managers quickly assess the situation seeking a match to make a rapid decision (Klein, 2008). Klein notes that the RPD model exemplifies "Herbert Simon's (1957) notion of satisficing, looking for the first workable option rather than trying to find the best possible solution" (p. 458). Instead of comparing alternatives before making a decision, experienced program managers "assess the nature of the situation and, based on this assessment, select an action appropriate to it" (Klein et al., 1993, p. 107). The RPD model blends intuition with pattern matching and analysis with mental stimulation (Klein, 2008). This blend of intuition and analysis also corresponds to System 1 and System 2 thinking described under Dual-Process Theory (Klein, 2008). Klein (2008) points out that "a purely intuitive strategy relying only on pattern matching would be too risky because sometimes the pattern matching generates flawed options" (p. 458).

Klein also notes that the alternative, "a completely deliberative and analytical strategy would be too slow" (p. 458). As shown in Figure 4, Klein (2008) notes that the RPD model "hypothesis that the first option considered is usually satisfactory" (p. 458).

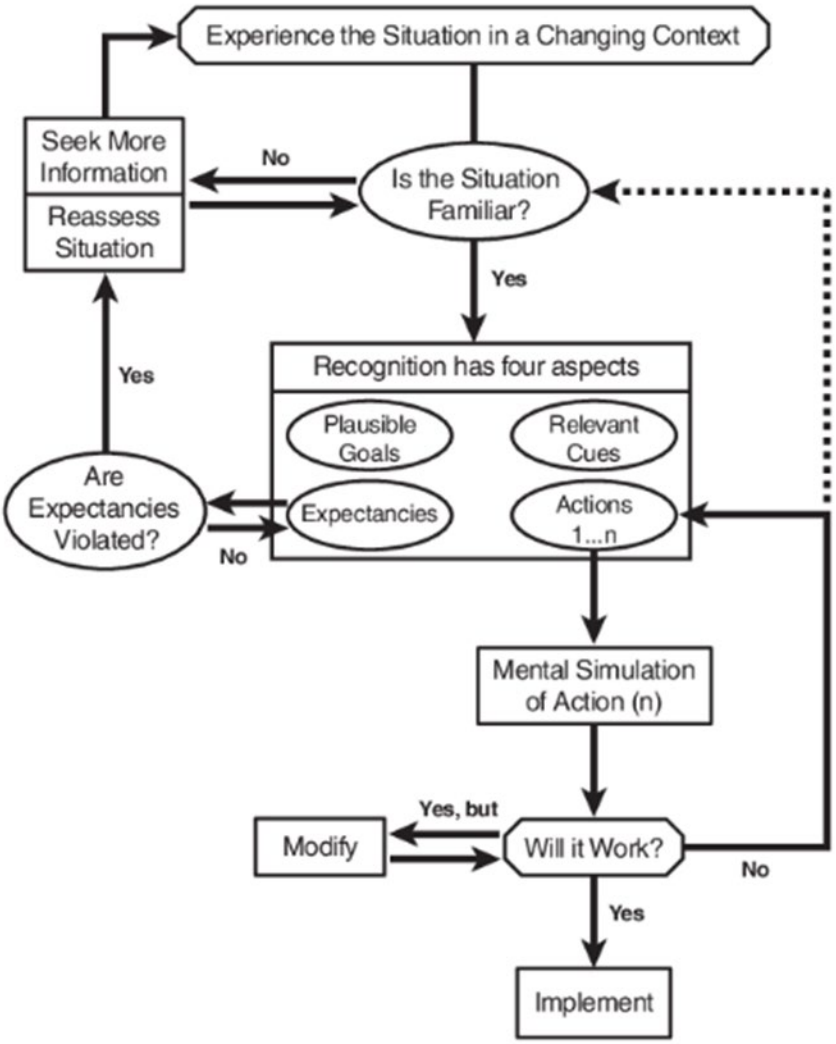

Figure 4. Klein's Model of Recognition Primed Decision Making. Source: Klein et al. (1993).

G. SITUATION AWARENESS

Situation awareness is a theoretical contribution of NDM emerging from the concept of attention (Hoffman, 2015). Hoffman (2015) states, "attention presents to consciousness an awareness of what we are perceiving, in terms of the concepts and

categories we already know (memory)" (p. 76). In citing Ebbinghaus and Pillsbury, Hoffman (2015) states that being mindful of what we are noticing in the environment "allows us [to] make judgments and decisions" (p. 76). Endsley (1995), as cited in Hoffman (2015), identifies three levels of situational awareness:

> Level 1 SA concerns the meaningful interpretation of data (i.e., perception), the process that turns data into information….
>
> Level 2 SA concerns the degree to which the individual comprehends the fuller meaning of that information…It involves integrating many pieces of interacting information, forming another higher-order of understanding, prioritized according to how it relates to achieving the goals….
>
> Level 3 SA is the mental or imaginal projection of events into a possible future. In complex domains, the capacity to apperceive is a key to the ability to behave proactively and not just reactively. (p. 77)

Endsley (1995), as cited in Hoffman (2015), "Situation awareness is critical to successful operation in dynamic domains where it is necessary of the domain practitioner to accurately perceive and understand the project action and events in the environment" (p. 77). As a result, attention provides awareness, which supports a program manager's ability to anticipate events via mental simulation (Hoffman, 2015).

H. RASMUSSEN

Rasmussen developed the theory on human performance after studying humans' decision-making processes involved in industrial tasks (Klein et al., 1993). The study resulted in Rasmussen observing and classifying three distinct types of information processing: skill-based, rule-based, and knowledge-based (Rasmussen, 1983). Embrey (n.d.) credits Rasmussen's classification and states, "This scheme provides a useful framework for identifying the types of error likely to occur in different operational situations, or within different aspects of the same task where different types of information processing demands on the individual may occur" (p. 1). Figure 5 shows the classification system developed to distinguish the three behavior types and their interrelation.

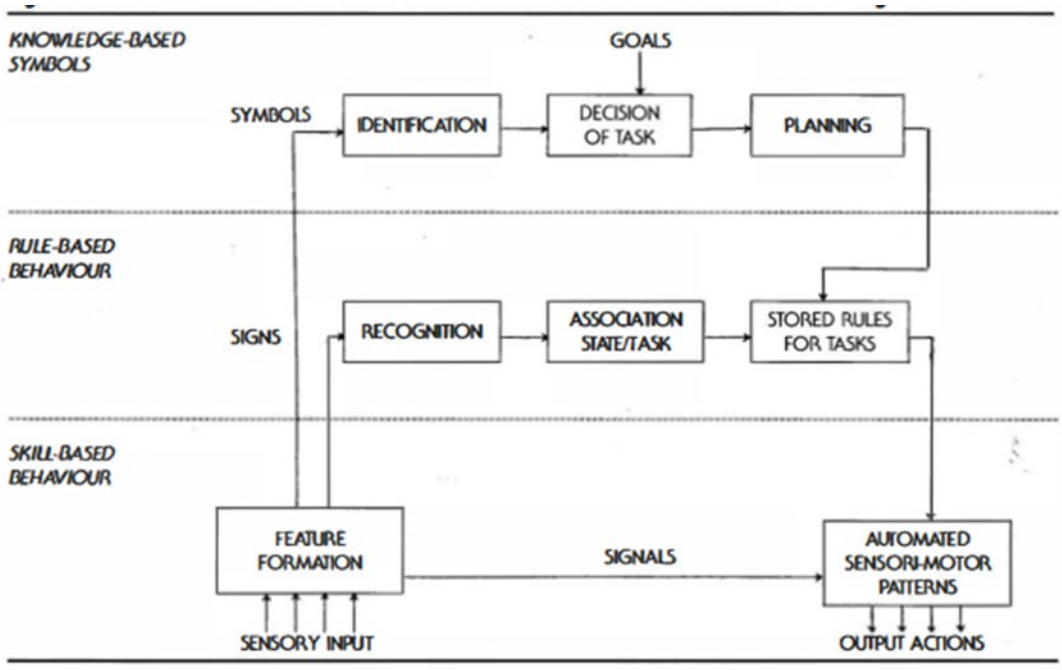

Figure 5. Schematic Model of Three Different Levels of Human Information Processing. Source: Klein et al. (1993).

Skill-based behaviors initiate from a triggering event, like a stoplight turning red or an alarm sounding, which determines the decision-maker's response (Klein et al., 1993). The decision-maker's response is automatic and learned from repeated behavior, allowing for rapid adjustments, as feedback is received (Klein et al., 1993). Since responses are almost second nature, the decision-maker responds subconsciously and action occurs with minimal thought.

Rule-based behavior is the next level of decision-making and most often seen in an environment when the individual is confident and familiar with the work. Recognition of an event requires a sign to invoke a rule that dictates a behavior based on experience or formal training (Rasmussen, 1983). Knowing where to look for the rule is also essential and correlates to the decision-maker's experience (Rasmussen, 1983). Rule-based behavior is goal oriented governed by the stored rule formulated by the end results (Rasmussen, 1983).

Knowledge-based behavior is the third category. According to Rasmussen, this category of human behavior emerges when the decision-maker is "Faced with an environment for which no know-how or rules for control are available from previous encounters" (1983, p. 259). In the knowledge-based mode, the decision-maker is operating in a conscious manner responding carefully and slowly (Embrey, n.d.).

Based on Rasmussen's classification system, a program manager makes decisions based on skill, rule, or knowledge-based information processing. Decision-making is a learned process that occurs in the reverse order described in this subsection. For example, a program manager obtains their knowledge under the tutelage of someone with more experience in the program, generally a professor or superior officer, while completing their credentialing duties. Then they graduate to a more rules-based behavior. Program managers gain experience and develop their skills when they are able to recognize when the rules will apply and where to look for the rules. Finally, the program manager learns the skill set and their behavior progresses to the advanced skill-based behavior where information processing is almost automatic.

I. CHAPTER SUMMARY

The purpose of this chapter is to provide a literature review on a few of the decision-making frameworks, processes, and models relevant to this research. The objective of providing an overview of these decision-making theories based on plausible thinking methods and models is to provide readers with basic knowledge on existing literature and research on the topic of decision-making. Specifically, this chapter introduces how sensemaking, situational awareness, emotions, and experience may influence a program manager's decision-making process. This literature review also creates the foundation for understanding the qualitative data presented in Chapter IV and used to support this research's theory on "how the program manager gains insight in the decision making process" (Jones, 2020, p. 16).

III. RESEARCH METHODOLOGY

This research utilizes an interpretivist framework with an inductive approach to arrive at this study's qualitative component. Qualitative research in the form of ethnographic interviewing was the method used for gathering information. Ethnographic interviewing focuses on observing human behavior for "gather [ing] non-numeric data [to] generate a theory to support such data" (Baker & Benjamin, 2018). Qualitative data was gathered from interviews using grounded theory's methodology using a series of open-ended, process-oriented questions intended to draw on a program manager's experiences and investigate the challenges associated with managing and executing a program of record as defined in the DOD 5000.02. This research uses the qualitative data to reach our end-state by weaving in research subjects' personal experiences to explore the hypothesis of how a program manager makes decisions.

During the first phase of research, each project team member interviewed one program manager of choice. Each program manager met our inclusion criteria of currently occupying a program manager position. Each team member conducted one telephone interview, resulting in three interviews. To ensure the relative objectivity of results, Jones (2020) request that all interviewers ask the same six research questions to use as reminders of the information that needed to be collected and why. During the interview, specific questions served as prompts to elicit responses that are more detailed. Similar master's theses, MBA Professional Projects, and Joint Applied Projects also sponsored by Jones (2020) under this Acquisition Research Program topic at the Graduate School of Defense at the Naval Postgraduate School (e.g., Baker & Benjamin, 2018; Donahue et al., 2018; Holcomb & Rumfelt, 2018; Neterer & Patrone, 2018) may have used the same or similar research questions.

1. Describe a time when your program was experiencing programmatic difficulties.
2. How do you feel about the overall process of the DOD Acquisition Process? Do you feel it is helpful in the successful execution of complex programs?
3. Do you think commercial industry is more efficient than DOD in developing products?

4. What do you think are some of the key challenges in developing a successful capability in the Acquisition process?
5. Which phases of the Acquisition process do you think are the most challenging?
6. What would you like to see change in the DOD Acquisition process that might improve the process?

The interviews occurred telephonically to record and collect data for transcription. To protect against the disclosure of any personally identifiable information, there are no proper names used in this paper's discussion and analysis. The interviewees appear under the pseudonyms Subject #1, Subject #2, and Subject #3.

Under the second phase, each team member analyzed transcribed interview data using grounded theory's constant comparative method articulated by Glaser and Strauss (1967). During analysis, each researcher investigates the challenges associated with managing a program of record, and how the program manager handles these problems. Naturally recurring words and phrases within the transcribed interview data formed analytic codes. Once initial coding was complete, the analyzed analytic codes showed patterns and themes within the data to form categories. The results of data collection, coding, categorization, and analysis appear in Chapter IV.

A. GROUNDED THEORY

The researchers interpret the collected data using the Grounded Theory method. In their 1967 book*, The Discovery of Grounded Theory,* Barney Glaser and Anselm Strauss define the Grounded Theory method as "the discovery of theory from data systematically obtained from social research" (p. 2).

According to the Grounded Theory Institute's website (Glaser, 2021):

> It is a general method. It is the systematic generation of theory from systematic research. It is a set of rigorous research procedures leading to the emergence of conceptual categories. These concepts/categories are related to each other as a theoretical explanation of the action(s) that continually resolves the main concern of the participants in a substantive area. Grounded Theory can be used with either qualitative or quantitative data.

The resulting theory comes from data gathered in the study and not from other sources such as pre-existing knowledge, textbooks, or other research sources. The

grounded theory method allows researchers to target research subjects. The most popular method of conducting this research is through one-on-one interviews with members of a target research group. The research questions should be in a form that will help the researcher make sense of the interviewees' experience without any preconceived notions of the experience. The researcher analyzes the collected data. There are multiple levels of coding involved. In the first level of coding, the interviewer reads the transcript and looks for particular themes or patterns in the data to see where patterns emerge. Categories appear from those patterns. This first level is complete when the interviewer is satisfied that there are no new categories in the data. In the second level of coding, the interviewer finds the patterns and categorizes them based on their relationship to each other. A bigger picture evolves from the first level coding review. The hypothesis will eventually appear in the categorization of patterns, and the process explained (Glaser & Strauss, 1967). Figure 6 below depicts how data evolves into theory.

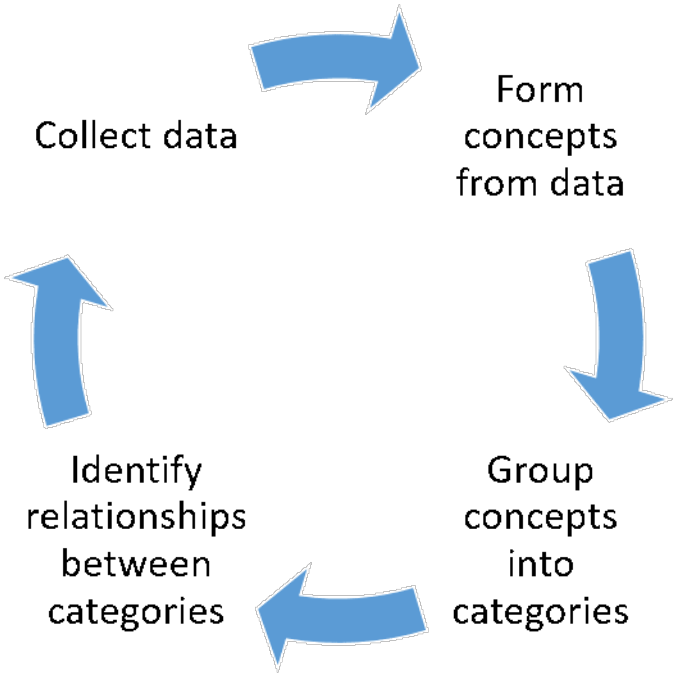

Figure 6. Grounded Theory Flow Chart. Source: Glaser (2021).

B. THE GIOIA METHOD

To facilitate theory making from data collection, the researchers utilized the "Gioia method." This methodology is first discussed 1990 in an article by Dennis Gioia and Evelyn Pitre entitled "Multi-Paradigm Perspectives on Theory Building" in the Academy of Management Review. In that article, Gioia and Pitre (1990) stated:

> What does it take to imbue an inductive study with 'qualitative rigor' while still retaining the creative, revelatory potential for generating new concepts and ideas for which such studies are best known? How can inductive researchers apply systematic conceptual and analytical discipline that leads to credible interpretations of data and also helps to convince readers that the conclusions are plausible and defensible? These questions represent the perennial concern among qualitative researchers and were the prime motivators for developing an approach to inductive research designed not only to surface new concepts, but also to generate persuasive new theories. (Gioia and Pietre, 1990)

In Gioia et al.'s 2012 journal article "Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Method," the authors note that the first-order analysis comes from the interviewee whereas second-order analysis comes from the researcher. As research progresses, the authors suggest that researchers "start seeking similarities and differences among the many categories" (p. 6). The authors went on to explain in that article "when all the first-order codes and second-order themes and dimensions were assembled, we then have the basis for building a data structure" (2012, p. 20). This is where we go from raw data to first-order codes to second-order categories. The codes and categories generate the theory (2012).

For the purposes of this research, we employed the Gioia method by analyzing each transcript separately. Although it took us several passes at each interview, first-order codes took shape and then the first-order codes evolved into our second order codes. The second-order codes came about by pulling back and analyzing the first order codes into a roughly researcher-based preconceived list of codes.

IV. DATA

This chapter presents each researcher's qualitative data, and the researcher's coding and categorization results using grounded theory's constant comparative method. This Joint Applied Project is part of a more prominent research topic sponsored by Raymond Jones (2020) under the Acquisition Research Program at the Graduate School of Defense at the Naval Postgraduate School. Jones has been an advisor for multiple research projects under this Acquisition Research Program topic at the Graduate School of Defense at the Naval Postgraduate School. As a result, we know there are overlaps with other similar master's theses, MBA Professional Projects, and Joint Applied Projects sponsored by Jones under this Acquisition Research Program topic (e.g., Baker & Benjamin, 2018; Donahue et al., 2018; Holcomb & Rumfelt, 2018; Neterer & Patrone, 2018) where the same or similar coding systems are used.

Using grounded theory, each researcher investigates the challenges associated with managing a program of record and how the program manager handles these problems. The key to grounded theory's constant comparative method is that the analysis process is repetitive and consists of two phases: initial coding and category development (Glaser & Strauss, 1967). Once initial coding was complete, the codes lead to naturally occurring patterns and themes within the data to form categories. Each team member began developing a theory to addresses the fundamental question of how the program manager gains insight during the decision-making process. To protect against the disclosure of any personally identifiable information, a coding system using pseudonyms Subject #1, Subject #2, and Subject #3 identifies each interviewee.

A. SUBJECT #1 INTERVIEW SUMMARY

Subject #1 is an Acquisition Category (ACAT) 1C and ACAT 1D program manager in the Army with the rank of Colonel. Subject #1's responses focused on explicit knowledge, tacit knowledge, and the environment. Table 3 depicts the analytic codes, the number of times Subject #1 referred to each specific category, and the specific category

based on the data gathered from Subject #1.[1] A discussion of each category of codes follows.

Table 3. Subject #1 Analytic Codes, Number of Times Mentioned, and Category

ANALYTIC CODE	DATA	CATEGORY
Identifying	23	Sensemaking 51
Triage/Response	11	
Organization	17	
Policy	4	Explicit knowledge 36
Process/ACQ process	19	
Design	4	
Strategy/Test	9	
Experience	24	Tacit Knowledge 42
Altering	9	
Fixing	9	
Control	18	Trust 37
Flexibility	11	
Delegation	3	
Risk	5	
Alignment	13	Environment 45
Focus	13	
Buy-In/Compliance	9	
Program Volatility	10	
Communication	4	Ability 25
Leadership	13	
Time Management	8	

1. Sensemaking

Subject #1 refers to sensemaking 51 times during the interview. Sensemaking is the process through which an individual will interpret and give meaning to their experiences. The analytic codes that make up the category sensemaking are identifying, triage, and organization. Subject #1's response to the interview questions were overall positive. There

[1] As previously mentioned at the beginning of this chapter, the codes gleaned from this interview may be the same or similar to other master's theses, MBA Professional Projects, and Joint Applied Projects also sponsored by Jones under this Acquisition Research topic. Our research subjects use jargon common to their profession and have similar experience in the Defense Acquisition field.

were moments where Subject #1 expressed that modifications to the acquisition process are necessary and described programmatic difficulties when developing a product that was software-intensive. The Army decided to anchor delivery based off a scheduled delivery date. The acquisition plan was a full development effort lead by the government from inception. Based on insight and experience, Subject #1 and their team improved the planned acquisition strategy by changing from the full development effort into a modified effort; by finding a commercial product that could meet the government's requirements with simple modification. Ultimately, this change in acquisition strategy kept the program on schedule. Subject #1 described the signs and symptoms of programmatic difficulty by making the following statements:

> If you have dealt with software (or any of your teammates have dealt with software) allot of the good and bad of those is that it is very easy to change, and it is very agile. But those same strengths become weaknesses if you don't manage it properly.

Subject #1 gave credit to their team and described how they were able to keep their program on schedule by stating:

> the team really decided to do was go ahead and move away from a government lead, you know developed from scratch and do a commercial procurement and modify that software code in order to meet the requirements and then the schedule going forward.

2. Explicit Knowledge

Subject #1 referred to explicit knowledge 36 times during the interview. Explicit knowledge appears in books, documents, reports, memos and the like. The analytic codes that make up explicit knowledge are policy, process, design, and strategy. Policy, acquisition process, acquisition plan all refer to the laws, rules and regulations associated with defense acquisition. Design, test and strategy refer to specific information, figures, or statistics used in program management to make decisions. Subject #1's response to the second interview question shows how subject #1 uses explicit knowledge of the acquisition process, the DOD 5000.02, and how to make modifications while administering the program in accordance with regulations. Subject #1 states the following:

> I think the overall ACQ process is good, if you take it with the intent that it could be always modified to fit a specific program or activity. I think if you take it as kind of a base DOD 5000 the way it is written then you just execute. This is not going to get you to a place where you are delivering capability on cost, schedule and performance. You know every program needs some sort of modification of the process in order to fit what it is you're trying to deliver for the service or Department of Defense.

3. Tacit Knowledge

Subject #1 referred to tacit knowledge 42 times during the interview. Tacit knowledge is different from explicit knowledge as that it is difficult to document and is the type of knowledge one obtains from time and experience doing the job. The analytic codes that make up tacit knowledge are experience, altering, and fixing. The majority of Subject #1's responses centered on the experience of solving problems on previous programs by customizing the acquisition plan. Subject #1 refers to the acquisition process and the DOD 5000.02 by declaring that it is not a strictly adhered to template, but a guide that will lead to the correct path. Subject #1 stated the following:

> I think you need to take what you are doing, where you plan on entering into the life cycle and what areas do you need to emphasize on…like do you have a technical risk? Do you have more of a performance area that you need to worry about? And then tailor it to the process to ensure you are hitting all of your major risk areas and able to truly track whatever...kind of your critical path.

4. Trust

Subject #1 referred to trust 37 times during the interview. The analytic codes that make up the category trust are control, flexibility, delegation, and risk. The analytic codes in the trust category refer to the amount of control or freedom provided the program manager. The focus of Subject #1's responses to the interview questions seems to center on wanting greater freedom to make changes in the acquisition process. For example, when responding to question #3, subject #1 provided a comparison of the private industry and the government that speaks to different levels of trust, and states the following:

> I don't think they are more efficient, I think they have a different goal. Commercial industry is focused on one thing, the ability to create profit for the company.

> Within the DOD, you now we don't have a profit or loss statement we deliver war fighting capabilities to the services in order to protect the nation and project force.

This conversation continued when Subject #1 gave an example of how commercial industry has a more decentralized authority with their management oversight and gave the following acquisition example:

> The other thing I think commercial industry would differ from DOD is…. for example, if I am Verizon and I am trying to work on 5G LTE for example: I can go ahead and pick other companies that I have worked with in the past or that I know are premier managers of technology or delivery for what I want to bring to the market. And I really don't have to explain very much why I picked vendor X, Y and Z to anybody else but maybe some of my senior leaders within the company. If I am working with a small or midsize company and they are not performing to the level I want or if costs overrun or whatever issue they could be running, I as a lead for Verizon could decide to go to a different vendor. And again there is not much of an area for which I would have to explain myself.

Subject #1 contrasted this example by discussing the checks and balances that the DOD requires through regulations.

5. Environment

Subject #1 referred to the environment 45 times throughout the interview. The analytic codes that make up the category environment are alignment, focus, buy-in, compliance, and program volatility. The analytic code alignment refers to having proper alignment with 1) requirements document, 2) technical capability, 3) service dollars, and 4) acquisition authority. Subject #1 indicated multiple times throughout the interview that without proper alignment, problems occur. Subject 1# provides the following statement regarding a successful program:

> you have to have proper alignment between the requirements document that is given to you by whichever requirement arm of the service delivers those and it has to be coordinated with technology that is needed to deliver the capability and the funding that is allocated by the service to mature the technology to meet the requirement and finally you have the proper acquisition authority from whichever milestone and decision authority to allow you to spend the resources for the technology to meet the requirement.

Subject #1 also discussed the unpredictable environment in the DOD's program management. Changes in technology can present new gaps in requirements, or funding and acquisition authority becomes obsolete. Even the smallest of changes can drastically threaten the success of a program. Subject #1 gave the following example of an unpredictable environment:

> When that program gets to milestone B it has to be aligned at least you are starting your program from a known "good" and you can progress forward through execution. But it is kind of a mixed bag on alignment, and anything could change as you go through execution to bring those out of alignment. You know the requirements community could identify a new gap. You know the enemy always has a vote and therefore immediately your requirements come out of alignment and you are going to have to work on the other three areas to get things back into alignment.

Subject #1's interview focused on environmental factors in four of the six interview questions. Subject #1 discussed the impact on programs by numerous environmental factors.

6. Ability

Subject #1 referred to ability 25 times during the interview. The analytic code that makes up the category ability are communication, leadership, and time management. The analytic codes in the ability category refer to the program manager's ability to lead, communicate and manage time. Subject #1 provided the following statement regarding the characteristics a program manager should have to be successful:

> I think you need to have a little of all the major disciplines, not to be an expert but be able to understand what your team brings to you and lead those other activities going forward. I really am a firm believer that leadership is the number one-character trait that the PM needs to bring to the table.

B. SUBJECT #2 INTERVIEW SUMMARY

Subject #2 is a program manager at the Program Executive Office for Command, Control, and Communications-Tactical. Subject #2's interview occurred over the telephone. Total interview time was one hour and fourteen minutes. Qualitative analysis of

the transcribed interview data developed 24 analytic codes based on patterns observed throughout the transcribed interview data and grouped into five categories as seen in Table 4.[2]

Table 4. Subject #2 Analytic Codes, Number of Times Mentioned, and Category

ANALYTIC CODE	DATA	CATEGORY
Alignment	46	Environment 74
Stakeholders	18	
Strategy	10	
Challenges	51	Sensemaking 196
Self-Awareness	52	
Motivation	42	
Organizing	51	
Confidence	9	Trust 29
Relationships	4	
Transparency	5	
Honesty	3	
Forthrightness	8	
Principles of Program Alignment	91	Explicit Knowledge 175
Recommendations	12	
Capability	22	
Trades	21	
Documentation	29	
Experience	10	Tacit Knowledge 108
Mathematics	4	
Expectations	25	
Layout	10	
Tailor	10	
Technology	35	
Leverage Program Alignment	14	

[2] As previously mentioned at the beginning of this chapter, the codes gleaned from this interview may be the same or similar to other master's theses, MBA Professional Projects, and Joint Applied Projects also sponsored by Jones under this Acquisition Research topic. Our research subjects use jargon common to their profession and have similar experience in the Defense Acquisition field.

1. Environment

The category environment derives from patterns within the data when Subject #2 refers to the acquisition process's essential elements. Throughout the interview, Subject #2 mentions the environment 74 times. The analytic codes that construct this category are alignment, stakeholders, and strategy. These analytic codes define the internal structure and the external surroundings or circumstances that Subject #2 continuously maintains when driving for the next phase of the acquisition process. Subject #2 references the analytic code alignment the most often for gaining insight into the decision-making process.

In the following interview excerpt, Subject #2 describes the typical program environment during a moment of retrospection.

> We had made the acquisition process work very efficiently and smoothly when we had four things aligned. When you have a valid requirement that is achievable, you have a technology base that is realistic and has a clear path to fruition. You have funding aligned in the right years and the right color, and you have the right acquisition authority… Having those [four] things tightly aligned in the strategy [and] bought in by the entire Service, it can work very well.

Subject #2's perspective on the environment is that the acquisition process is most efficient when the acquisition community has four things aligned: achievable requirements, realistic technology, adequate funding, and the right acquisition authority. Having all four of these elements combined (also referred to as the principles of program alignment) creates alignment in the environment, which Subject #2 uses to manage and prioritize tasks when driving for the next phase of the process. Alignment, strategy, and stakeholders are the three elements of the environment Subject #2 uses to measure, influence, and ensure program success.

2. Trust

The category trust derives from patterns within the data when Subject #2 relies on others for insight into the decision-making process. Subject #2 refers to trust 29 times. The analytic codes that form this category are confidence, relationships, transparency, honesty,

and forthrightness. Throughout the interview, Subject #2 references the analytic code confidence the most often for gaining insight into the decision-making process.

Program management within the DOD is becoming increasingly complex. A program manager's role is to ensure a successful capability solution delivers on time and within the constraints of multiple review levels, statutory requirements, rigorous requirements, inevitable time constraints, and constrained budgets. A program manager's challenge is to manage many or all of these areas with each other; sometimes, this requires help from others. When relying on others for input, a level of mutual trust must exist between the individuals involved. During the interview, Subject #2 defines the importance of trust between members of the acquisition community.

> A key component is making sure those making recommendations feel they can speak truth to power. They can tell the absolute hard truth if required. You want to have a climate where team members feel they can speak up and say in the absolute forthright, and that is a valued response versus someone perceived as just always trying to slow the process down, or just trying to look at things as half empty versus half full. You have to create an environment where your subject matter experts feel like they can freely get all the realm of information, and not hold back on because they do not want to feel like they are going to be the one that's going to vote no in a room full of people who are voting yes. You know, a lot of your experience of having dealt with hard situations, hard problems, and wicked problems is the person that has the experience in that particular technology. That there is confidence in their recommendation, and then there is a confidence that they are going to speak frankly in giving that recommendation.

In this passage, trust occurs in the environment when Subject #2 relies on others for recommendations. Additionally, trust is apparent during moments of collaboration when members feel comfortable speaking up and giving their unsolicited opinion without fear of negative repercussions. The organization's experience in dealing with hard problems over time suggests trust within the organization builds over time. Additionally, the level of trust has to be mutual and fostered amongst relationships. While perceiving trust, Subject #2 is vulnerable to building on others' knowledge to achieve a higher state of knowing.

3. Explicit Knowledge

The category explicit knowledge derives from patterns within the data when Subject #2 gathers information for identifying decision-making alternatives. Subject #2 refers to explicit knowledge 175 times during the interview. The analytic codes that form this category are principles of program alignment, recommendations, capability, trades, and documentation. Throughout the interview, Subject #2 mentions the analytic code principles of program alignment the most often for gaining insight into the decision-making process.

During capability development, a program manager relies on many different types of explicit knowledge for insight during decision-making development. Types of explicit knowledge can include systems engineering plan, National Defense Authorization/ Appropriation Act, acquisition plan, and contracts. To accomplish goals and meet objectives, a program manager must integrate and understand each document's intent and maintain an in-depth knowledge of the interrelationships amongst documents. A program manager's challenge is to integrate all of these areas. Sometimes, this requires others' help. During the interview, Subject #2 explains what provides a comfort level for making a decision.

> So, we can go back to how well are we aligned in that process of those for those four areas [achievable requirements, realistic technology, adequate funding, and the right acquisition authority]. It is kind of our measuring stick as we look at a program, and if one of those four things are not aligned, then you know that is where you got to go and take action to get that alignment. It gives you direction.

During retrospection, Subject #2 notices uncertainty in the environment when misalignment exists and creates motivation that alignment needs restoration. Explicit knowledge occurs in the environment when Subject #2 refers back to the four principles of program alignment for data to determine where the breakdown in alignment occurs. Explicit knowledge provides Subject #2 the ability to make timely decisions based on facts.

4. Tacit Knowledge

The category tacit knowledge derives from patterns within the data when Subject #2 identifies decision-making alternatives using feeling, instinct, and creativeness rather than facts. During the interview, Subject #2 refers to tacit knowledge 108 times. The analytic codes that form this category are experience, mathematics, expectations, layout, tailoring, technology, and leveraging program alignment. Subject #2 references the analytic code experiences the most often for gaining insight into the decision-making process.

In addition to maintaining a high level of understanding of the program's goals and objectives, a program manager must also share personal knowledge gained from experience with the organization and stakeholders to create new knowledge. The challenge with sharing tacit knowledge is that it requires different leadership styles to ensure the knowledge is well communicated and understood. The following quote provides insight into how Subject #2 matches the situation with personal knowledge gained from experience.

> Lots of we run into though is parts of the process everyone just looks at the checklist and says you got to put a peg in every one of those holes, and those holes do not work for you. So that is the game. You got to explain why you are not doing this one, why it does not make sense to spend money to go or time to do those things because, ultimately, it will not benefit the capability. To just point out, hey, this one step is irrelevant. It depends on the program. Each of them can be irrelevant, other than the major milestone decisions themselves which you have to document to obligate the government, but there is a lot of steps under there that can be tailored, and you have to know that and be willing to stand up and make that case.

During retrospection, Subject #2 notices confusion over the acquisition process, which evokes sensemaking in the form of organizing. The confusion creates motivation that the process will take longer than necessary; therefore, a decision to remove process ambiguity from the environment is essential. Tacit knowledge occurs in the environment when Subject #2 talks about tailoring the acquisition process. Subject #2's knowledge of tailoring the acquisition process implies the experience of successful tailoring in the past

and a high comprehension level of program requirements and acquisition process and procedure.

5. Sensemaking

The category sensemaking derives from patterns within the data when Subject #2 describes an experience and organizes the order of events to make sense of them. During the interview, Subject #2 refers to Sensemaking 196 times. The analytic codes that form this category are challenges, self-awareness, motivation, and organizing. Subject #2 references self-awareness the most often for gaining insight into the decision-making process.

a. Scenario 1

In the following scenario, Subject #2 retrospectively describes the experience of a time when the acquisition community accepts unachievable requirements.

> At the beginning of a program, you are working with your customer or your user rep on the requirements. In this bigger case, this was one of the problem areas; we had accepted requirements that were unachievable. Our user wanted a certain level of throughput or capability, but he wanted it very small and light. In this particular case, we had concerns with not the technology and getting the communications through, but with the packaging. So, the lessons kind of learned there are, just before you take that, you have to make sure that those requirements are [achievable]. So you got to be willing to push back on those, and potentially even the way the program should get that right before you start it because when you start it, then that is when the program starts, and it starts taking hits that were not achieving milestones and the requirements on time. So, after we had to receive them, we had to go back and get those changed.

At the beginning of the scenario, the acquisition community accepts unachievable requirements, which causes misalignment in the environment. Subject #2 notices the misalignment, which initiates sensemaking. Subject #2 relies on tacit knowledge in the form of experience to establish motivation that the requirements are unachievable. The action of pushing back on the unachievable requirements implies the program manager's self-awareness and trust through confidence. The process of going back to change the unachievable requirements implies explicit knowledge. The combination of sensemaking,

tacit knowledge, trust, and explicit knowledge provides Subject #2 with enough insight to decide to go back and get the requirements changed.

> And so, we went and did the market research to find out what is achievable as far as weights for that size of a satellite dish, and laid those things out along with the weights and did a matrix of available metrics backed up by the mathematics behind the gain on a particular dish. Not trying to get too technical, but it was a very technical deep dive. What it came down to is, do you want less performance and lighter weight? Or do you want more performance with a heavier weight? Then you had a wide range of users that were going to use this system. Some of them were okay with that because they had plenty of room to accommodate the system. We had some other users that had very strict weight. So, part of the challenge was you are designing one system to meet a lot of requirements, which is good and bad, right. So that is a trade itself. I mean, one system that everyone uses makes it easier to train, makes it easier to sustain and maintain, but then there are trades in on how usable the system is for every particular instance of that capability. If you wanted the same level of performance, it would require more weight, and there were some technology choices to be able to do that.

During this phase of the scenario, Subject #2 starts to define decision-making criteria by gathering information on achievable requirements. The action of market research and a very technical deep dive suggest the gathering of tacit knowledge. The action of laying out market research results into a matrix of available metrics suggests the transferring of tacit knowledge gained from market research to stakeholders to create explicit knowledge. The combination of tacit knowledge and explicit knowledge provides Subject #2 with the additional insight to change the unachievable requirements.

> The challenge we had was one that the game changed but also making sure that the stakeholders were aligned in making that trade is. What typically happens is, the trade will be made early in the program, leaders change out, stakeholders change out, and you get a year or two into the program, and people started asking, “Well, why aren’t we at a, in this case, a particular weight?” So we laid out those trades, and it was important to get all the stakeholders together and make sure everyone has the same expectations and at some point, you got to make a decision that not everybody is going to be happy with, and you have to admit that up front and go forward. If not, you will never deliver capability because you will continually be doing. And then once you kind of came to those conclusions, the decision was the hard decision on that trade. So, the requirements change from a shoulder lift to the weight they would be able to lift over their heads. So, we made the change, and that is a very important beginning of that. The key point is,

> bringing the stakeholders together, and having that, having the transparency of making that trade.

Subject #2 continues to rely on sensemaking, tacit knowledge, and explicit knowledge during this scenario's final phase. Subject #2 relies heavily on tacit knowledge gained from experience to establish motivation that novice stakeholders may not fully understand how program requirements have evolved since requirements generation. Therefore, Subject #2 relies on organizing and explicit knowledge of requirements to incorporate transparency into the decision-making process. Explicit knowledge in the form of consensus decision-making provides Subject #2 the opportunity to manage stakeholder knowledge and expectations and realign stakeholders to make sure they understand the tradeoffs to restore the environment's alignment. Subject #2's self-awareness also presents itself again during stakeholder decision-making to influence and force the timeliness of the decision. The combination of sensemaking, explicit knowledge, tacit knowledge, and trust are the inputs to gain insight into the decision-making process to get the unachievable requirements changed.

b. Scenario 2

In the next example, sensemaking occurs again during the interview when Subject #2 describes process challenges in developing a capability.

> Actually, they were developing that capability for warfighting function based on some of the things the adversary is doing, and when the threat evolved some of those things changed, and that is kind of why we use our program alignment to help us do that. We could go back to those principles we talked about of program alignment. We look at those. We look at the recommendations from the particular expertise that merged this particular technology. I rely on folks that I have built relationships with; I have trust relationships with that can provide that I can count on for a forthright, honest assessment of that technology. You personally have to be okay with making decisions where you do not have perfect information. I have seen guys try to do that, and you will fail because you will never get perfect information, and you have to be okay with, at times, making the wrong decision and then having the personal courage to go back and change that decision or adjust that plan or decision according to new information, or maybe you did not mitigate all the risks. To me, it is really all about, being able to create an environment where you get the best information and the most forthright information, developing a team with the right expertise and

> experience, developing the relationship that has the confidence and recognition to get you to make the decision now versus waiting another two years. In most cases, it is the best case, and then being willing to adjust that decision after it has made. That is kind of what I tend to do.

In this scenario, an unexpected fact of life change causes Subject #2 to notice an interruption to alignment in the program's environment. Subject #2 instinctively relies on explicit knowledge from the principles of program alignment for quantitative data. Subject #2 relies trust through relationships to gather assessments, recommendations, and honesty from others to use as additional information not available as explicit knowledge. While weighing the information acquired, Subject #2 recalls tacit knowledge based on the experience of seeing others fail, which establishes motivation that decision-making success relies more on the decision's timeliness and less about making the right decision. Self-awareness in the form of courage to go back and change the decision weighs heavily in making the decision. The combination of sensemaking, explicit knowledge, tacit knowledge, trust, and the element of time provide Subject #2 with insight into the program's environment and the inputs used for decision-making.

c. Scenario 3

In the next example, Subject #2 demonstrates sensemaking during the interview when offering thoughts on parts of the acquisition process that are less helpful to execute a successful program.

> I think the biggest thing is; we look at the acquisition process; it is a process that has to be tailored for what you are doing. If you look at the big charts that everyone points to and says, 'that is the acquisition process.' Well, no program is going to do everything on that chart. Those are the steps required in every situation ever dreamed up, but successful programs are able to tailor that process to be able to be successful. A lot of times, we will get bogged down because we will see the checklist and think we have to do every single one of those things, and we will start working on them, and time goes by, and we missed that opportunity. Especially in my community, where communications with technology turn pretty quick. You know, you may start developing a program, and if you wait too long, you may be obsolete before you get it.

Sensemaking occurs when the acquisition community starts to get bogged down during the acquisition process because multiple perspectives within the acquisition

community conflict on what parts of the process are required. Tacit knowledge based on experience relies on establishing motivation that further action is required to influence the speed of the process before the opportunity to deliver a successful capability is no longer available. Tailoring implies that Subject #2 has previous experience tailoring the acquisition process in situations where time is the factor for decision-making. The combination of sensemaking and tacit knowledge provided Subject #2 insight into the program's environment and used as inputs to decision-making.

> So, you really have to ask is that particular step in the acquisition process needed, and you also have to have those four things. So those [four] things are the facts that lead to a good decision on making sure that you have that alignment because you can get bogged down in the JCIDS process right. So, if you try to do every single step in that JCIDS process, it can take a lot of time, and you got to be willing to take some risk and mitigate that risk to get that program alignment. So, you got to be able to tailor it to get the right things you should be doing, eliminate things that are not required, and then be willing to go and advocate for not doing those things that are not helpful to deliver that particular capability.

At this final phase of the scenario, Subject #2 continues to shape decision-making by gathering information through sensemaking and tacit knowledge. Explicit knowledge also integrates as facts to use as a guide for tailoring the process to ensure program alignment. The combination of sensemaking, explicit knowledge, and tacit knowledge is relied upon to provide the insight required to make a sound decision.

C. SUBJECT #3 INTERVIEW SUMMARY

Subject #3 is an Army Colonel ACAT 1C program manager. The interview with Subject #3 was very, very succinct. While Subject #2 gave over an hour's worth of responses, Subject #3 only gave 15 minutes. Subject #3 received the interview questions in advance to allow adequate time to formulate responses. Subject #3 spent some time thinking about the questions provided and gave honest and forthright responses. Subject #3's responses focused on sensemaking, tacit and explicit knowledge, and trust/frustration.

Table 5 depicts the analytic codes, the number of times Subject #3 referred to each category and the specific category based on the data gathered from the interview.[3] Discussion of all categories follows.

Table 5. Subject #3 Analytic Codes, Number of Times Mentioned, and Category

ANALYTIC CODE	DATA	CATEGORY
Pattern Identification	6	Sensemaking 13
Recall	3	
Gut Feelings	4	
Acquisition Rules	3	Explicit knowledge 10
Education	3	
Meetings	4	
Experience	4	Tacit Knowledge 11
Innovative/Customizing	3	
Problem Solving	4	
Oversight/Control	3	Trust/Frustration 11
Empowerment/Frustration	6	
Decentralized authority	2	
Risk	2	

1. Sensemaking

Subject #3 referred to the codes for sensemaking 13 times in the interview responses. Although the actual numbers of codes are fewer compared to the other research subjects, this was a very short interview. The analytic codes derived from Subject #3 for sensemaking include pattern identification, recall, and gut feelings. Subject #3 pulled responses from an incredible extensive acquisition background in the Army and doing buys for equipment in theater. Subject #3 was very focused during the interview and gave the impression keen awareness of radio solicitation failures from the past. Subject #3 did not

[3] As previously mentioned at the beginning of this chapter, the codes gleaned from this interview may be the same or similar to other master's theses, MBA Professional Projects, and Joint Applied Projects also sponsored by Jones under this Acquisition Research topic. Our research subjects use jargon common to their profession and career experience and have similar experience in the Defense Acquisition field.

want to recreate those failures. Subject #3 applied knowledge of past performance problems to the current situation in order to prevent contractual failure. Subject #3 stated:

> We found a lot of issues. At one point, we stopped accepting deliveries of those forklifts, stopping all cash flow to the company. It took a while to work through this and the company really never did respond to the Government's satisfaction, so we ended up having to re-compete the contract. And they competed against another, a larger vendor, and they lost.

Based on pattern identification and gut feeling, Subject #3 sensed and predicted potential contractual performance problems early by identifying past contractual patterns, applying that information to the current solicitation, and acting, even if the result was less than desirable for all parties. Subject #3 stated:

> So things kind of went south, but at the same time, we couldn't stand by and stay with a company that wasn't being fair to the government, so we made a hard decision, and had repercussions on our industry partner.

Subject #3's ability to follow gut feelings along with recall from similar situations prevented a bad outcome.

2. Explicit Knowledge

Subject #3 referred to the category for explicit knowledge 10 times in responding to the interview questions. The category of explicit knowledge in Subject #3's interview was inclusive of direct and in-person knowledge or experiences that Subject #3 had obtained during a long acquisition career. This could be from experiences in theater, or from schooling, or in-person meetings that Subject #3 has had with leadership and vendors. The analytic codes derived from Subject #3 that form the category explicit knowledge include acquisition rules, education and meetings. Subject #3 pulled responses from an extensive acquisition background in the Army and doing buys for equipment in theater. Subject #3 stated:

> It was about 3 years ago before I was on the program, the Army decided it would change right in the middle of a major source selection for software-defined single channel radios that they were going to move to two channel radios. And so, they really had to stop an ongoing source selection after all the bids and everything were in and we have expended a lot of resources, revive the RFP, open up discussions for the vendors and ask them to come

> back for a two channel. That was an 18–24-month float. So, it was a tremendous challenge.

Subject #3 pulled the data to respond to the interview question from personal experience in conducting a source selection. Subject #3 did not glean this information from any other source other than living it. Subject #3 pulled information personally gathered from education and experience in the field to make assumptions on making decisions. Subject #3 stated:

> So, the small "A," the actual DOD 5000 and the acquisition process have actually gotten more tailorable over time. And if you use it correctly, it can still be responsive to the Army's needs or to the user's needs. You just have to go in with the attitude of I'm going to tailor this process. I'm going to do the events that make sense and then you get stakeholder buy-in to allow you to skip certain things or tailor certain things down to the minimum amount of effort.

Subject #3's use of direct and in-person knowledge or experiences to respond to interview questions was explicit knowledge.

3. Tacit Knowledge

Subject #3 referred to the category for tacit knowledge 11 times in responding to the interview questions. Tacit knowledge means something entirely different from explicit knowledge. While explicit knowledge is something tangible, like a policy, or field of study, tacit knowledge is something less tangible and comes more from a combination of explicit knowledge and experiences in analyzing situations. Most of Subject #3's responses were a mixture of explicit and tacit knowledge. Experience, innovative/customizing and problem solving comprise the codes under this category. Subject #3 stated:

> So, why start too early if you don't have to, develop things you don't need to develop, leverage commercial market-derived technology as much as you can.

This response represents a combination of knowing what happens if you start a source selection too early (i.e., starting over mid selection) mixed with the experience of knowing that the Army has had to leverage the commercial market in order to get products out to the war fighters in a timely basis.

4. Trust/Frustration

Subject #3 referred to the category for trust/frustration 11 times in responding to the interview questions. The trust/frustration second tier analysis of Subject #3's interview came from an undertone of unhappiness with the whole Acquisition Process. The analytic codes derived from Subject #3 that forms the category trust/frustration include oversight/ control, empowerment/frustration, decentralized authority and risk. Subject #3 pulled responses from an extensive acquisition background in the Army and doing buys for equipment in theater. Subject #3 stated:

> Well, the industry can control all the variables required to get good development and lean out their processes to become efficient. The Department of Defense cannot control hardly any of the variables that are involved in developing products. So, there is a lot of instability in a lot of areas.

Subject #3 also is very opinionated about how processes are going. Those opinions came from schooling and work on the job.

> I've read several studies as part of my war college thesis about why programs fail. One of the largest, well the two biggest ones is requirements instability and funding instability. And so, in my opinion, those were the bigger problems. While the Army's Futures Command was set up to try to get at the requirements process, and that's kind of…. we'll see where that is effective in dealing with that…. nothing has been done with the PBB&A process.

Subject #3's responses resonated with an overall dissatisfaction regarding the acquisition process.

D. CHAPTER SUMMARY

The data from Subjects #1, #2, and #3 consists of a range of four to six categories within the decision-making process. Sensemaking, tacit knowledge, explicit knowledge, and trust are common categories appearing in all three interviews. Sensemaking and explicit knowledge are categories referenced the most and appear to influence our subject's decision-making process aside from environmental factors such as budget, requirements, and operational culture. Figure 7 shows a summary of each identified category. Figure 8 is a summary total for each category for all subjects.

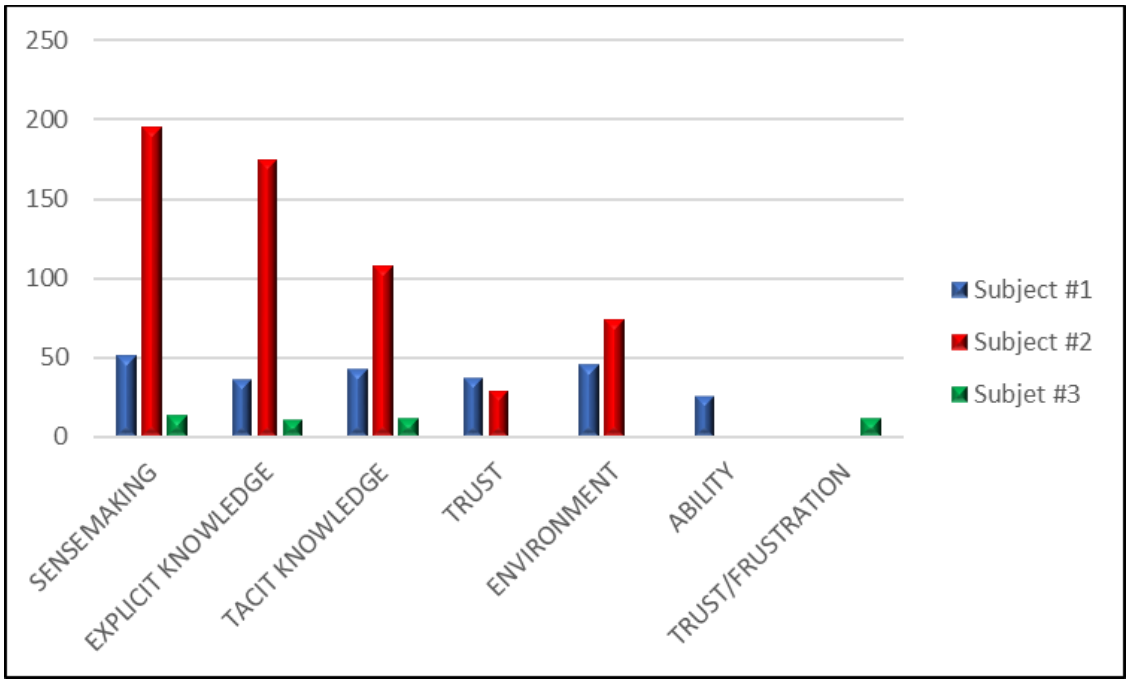

Figure 7. Subject #1, #2, and #3 Categorical Interview Data

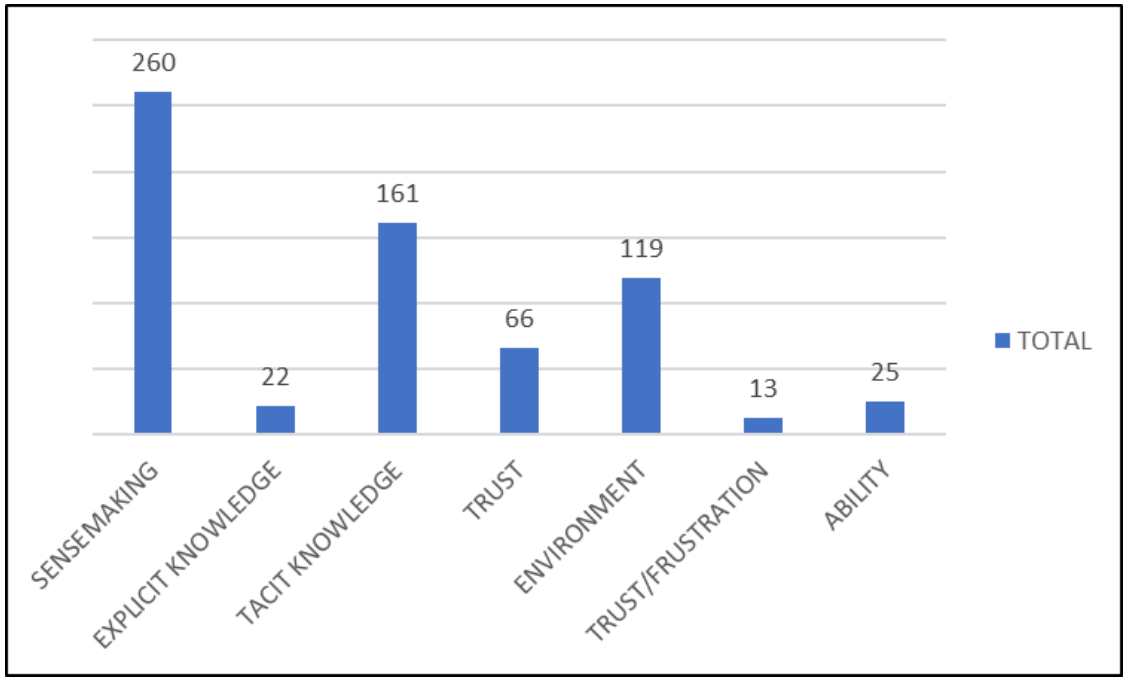

Figure 8. Subject #1, #2, and #3 Combined Categorical Interview Data

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V. ANALYSIS

This chapter presents our research-obtained extracted code analysis. The topics of sensemaking, explicit and tacit knowledge, and environment came up frequently in our findings. This chapter also offers two findings and theories concerning the findings regarding decision-making in the defense acquisition environment.

A. ANALYSIS OF FINDINGS

Data analysis from the three research subjects provides insight into decision-making and how those insights correlate with program performance. Figure 9 shows the aggregate codes analyzed.

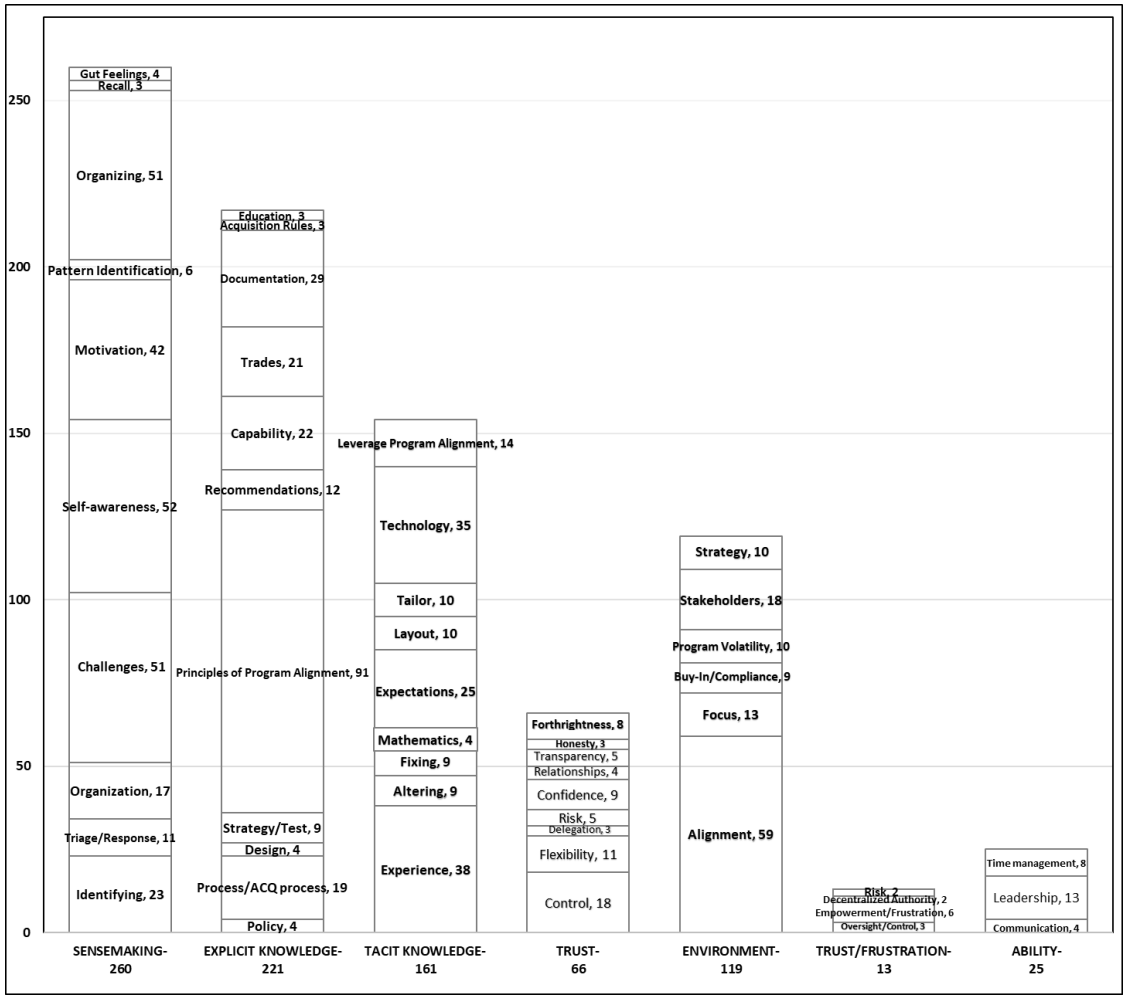

Figure 9. Cumulative Total of Analytic Codes per Category

The data shows that the program managers deal with challenging conditions by using the following behaviors: (1) sensemaking (260 instances); (2) explicit knowledge (221 instances), (3) tacit knowledge (161 instances); and (4) environment considerations (154 instances). Discussion of these topics follows:

1. Sensemaking

Figure 8 shows that the research subjects overwhelmingly used sensemaking in their decision-making process. These codes appeared over 260 times, on a collective and individual basis. The codes for sensemaking appeared as organizing/organization, motivation, self-awareness, challenges, prioritization and pattern recognition.

Sensemaking helps program managers decipher a situation, sizing it up and setting it up for resolution. These codes appeared in the data when the research subjects' understanding of the world became undecipherable, which is typical for the environment. The program managers used sensemaking to interpret what they sensed was raw data. After identifying a pattern, the program managers would categorize the new information, make sense of it and the unintelligible circumstance would become simple once again (Glaser & Strauss, 1967). Research Subject #3 demonstrated this behavior when dealing with contractors in theater. Subject #3 recognized a pattern of concern by the contractor, sat back and waited to see how it was going to play out. When performance under the contract started to suffer, Subject #3 put a stop to any further action by the contractor, canceled the contract and reissued the solicitation.

Sensemaking was also apparent by research subjects using knowledge, both explicit and tacit, and intuition to make sense of the unfamiliar (Glaser & Strauss, 1967). For example, Subject #1 had issues with his contractors. Subject #3 knew from schooling and experiences that program requirements documents needed to align with technology. If alignment does not happen, then he, as the program manager, is responsible for all issues that arise from the misalignment. Subject #1 learned during a testing event that the product did not meet the technical specifications from the requirements document. After several integrated product team meetings, it was apparent that the problem was unfixable without more money and time. Subject #1 used his knowledge of previous programmatic failures

and intuition to recognize that the path forward lead to failure. Subject #3 recognized the issue, framed it, and made a decision to stop production and cancel the contract. Sensemaking brought Subject #3 to that decision.

2. Explicit Knowledge

The extracted codes show that explicit knowledge is critical to ACAT 1 program managers because these codes appeared 221 times in the combined interview codes for the interviewees. The codes for explicit knowledge appeared as internal meetings, documentations, trades, capabilities, recommendations, principals of program alignment, strategy/test and design, process and policy.

Explicit knowledge is knowledge obtained personally by the user. Each of the research subjects has at least 25 years of relevant experience, both as warfighters and as program managers. Their experience levels ranged from being an end-user to years of acquisition experience going through the different milestones (and pre-milestone experience) to take a product or capability to theater, which indicates they have direct knowledge at both ends of the spectrum.

Since program managers operate in the Cynefin Framework category of the Simple to Complex domain (and not Chaotic), their decision-making behavior is contained in ordered environments, and is not chaotic (Snowden & Boone, 2007)**.** Simple and Complex environments are ordered environments with cause and effect in which the program managers to utilize their explicit knowledge and skills to diffuse and analyze problems (Snowden & Boone, 2007). Cause and effect environments are generally stable with set parameters (Snowden & Boone, 2007)**.**

All of the research subjects pulled information from their personal experiences (explicit knowledge) in order to resolve Chaos. These personal experiences ranged from schooling to actual on-the-job experiences. They assessed the facts of the situation, categorized them, and responded based on experience. As this researcher can affirmatively attest from extensive career experience in the same Joint Program Executive Office, the research subjects operate in a heavily process-oriented atmosphere. Testing situations are simple contexts where the program manager can identify the problem (i.e., throughput

issues, antenna issues, radio weight, housing size, etc.), categorize it, and respond appropriately.

Explicit knowledge benefits the program manager most by preventing improper categorization of decision-making processing. It also avoids missed reactions, throwing the program managers into the chaotic domain. "The most frequent collapses into chaos occur because prior success has bred complacency. This shift can bring about catastrophic failure" (Snowden & Boone, 2007, p. 2).

The research subjects are familiar with catastrophic failure, which is very common in the telecommunications environment in which these program managers operate. Their first-hand explicit knowledge, education and experiences have taught them to look for actions that would trigger catastrophic failure. Because no one becomes a program manager with the intent to fail, our research subjects are particularly sensitive to that prospect. Explicit knowledge and experience are invaluable to help them avoid falling into that domain.

3. Tacit Knowledge

The use of tacit knowledge to make decisions appeared in the interviews of all three-interview subjects. This category of code appeared 161 times in all three interviews. This code appeared as leveraging program alignment, technology, tailoring, layout, expectations, mathematics, problem solving, innovating/customizing and experience.

You cannot teach anyone tacit knowledge. It must be experienced first-hand. It is pattern recognition recognized from experience. To assess for familiarity, each program manager went through a mental process of classifying possible obstacles to programmatic success like slow delivery or adverse weather conditions. If a situation appeared similar (but not exact) to one they had seen in the past, they could access their tacit knowledge to help them apply their decision-making principles to the current situation. Utilizing the tenets of the Dual Process Theory, the research subjects subconsciously used System 1 and System 2 processes to look for patterns and then identified them in order to simplify the decision-making process (Klein, 2008). They applied their tacit knowledge into the current problem set.

This recognition of patterns forms the basis of Naturalistic Decision-Making theory (Klein, 2008). "Basically, proficient decision makers are able to recognize the situation as familiar, which gives them a sense of what goals are feasible, what cues are important, what to expect next and what actions are typical in that situation" (Klein, 2015, p. 58).

The NDM factor of pattern recognition affects program managers and their decision-making. It enables them to identify causation and establish expectations from experiences along with realistic goals. Ill-structured problems and uncertain dynamics can occur many ways, whether financial, technical, or informational. Shifting goals can come from multiple players, whether Congress, stakeholders, or even competing newer technology. Causation and expectations are essential for taking appropriate action or making a decision. The program managers used Klein's RPD model of NDM to handle the situations in the previous paragraph and focused on the critical clues and causal factors (ignoring the fluff). The program managers identify a familiar pattern and then they act accordingly.

4. Environmental Considerations

The codes for environmental considerations manifest in the interviews of all three-interview subjects. They appear 154 times in the combined interview codes. The codes appear as alignment, focus, volatility, and the culture and structure of the organization.

The code for "alignment" presented more than any other code, appearing to be the most important. Alignment is the proper positioning of all functioning parts of the program as they head toward the common goal. All interviewees described developing a capability used by the warfighters. They described their weekly meetings with their teams, making sure that their programs were in alignment and attending periodic meetings with their leadership. The tenets of cost, schedule and performance are necessary in the DOD acquisition environment. These meetings occurred to measure goal tracking.

Using the Rasmussen theory on human behavior, we applied the three-skill set theory to our research. Those skill sets include skill-based, rule-based, and performance-based decisions (Rasmussen, 1983). Program managers primarily make rule-based

decisions. The source of the rule-based decision-making is the DOD Instruction 5000.02. In that Instruction, there are rules on what to do to keep their programs in alignment.

Program managers obtain their knowledge about the environment under the tutelage of someone with more experience in the program, generally when they are a junior officer. They graduate to a more rules-based behavior when they become a program manager. Through their experience-gaining progress from being a younger officer in the Acquisition Corps, they have developed the skills to recognize when the rules will apply to them and where to look for them. After learning the skill set, their behavior progresses to advanced skill-based behavior where everything is almost automatic. This environment is where the research subjects spend most of their time implementing the tenets of the DOD Instruction 5000.02.

Small subsets of data show:

(1) Program managers use their experiences and knowledge to interpret and react to current situations to make decisions.

- All of the research subjects referenced past experiences when they responded to the interview questions. They readily divulged multiple examples of good decision-making and bad decision-making during their interviews. They all referred to those decisions with pride or regret at the outcome.

- Program managers are not in the business of making bad decisions and do not like to see programs or acquisitions fail. They are in the business of meeting the tenets of cost, schedule, and performance along with programmatic milestones. They cannot meet those tenets if poor decisions occur. Their past knowledge and experiences help color their responses in their decision-making process.

- The program managers applied their experience and tacit and explicit knowledge to current fact patterns in the hopes of either obtaining a similar result or avoiding a similar disaster. Having this knowledge at the forefront of their decision-making process has proven to be an invaluable tool in their

arsenal. They can identify problem areas encountered in the past to help them know where to go to seek assistance to avoid a problematic outcome. It also helps program managers know at what point to step in and when to let matters run their natural course.

(2) Reaction making is intuitive.

- All of the research subjects explicitly mentioned noticing a particular behavior and stepping in to remedy the situation before it got out of hand. There was no mention of how the subjects analyzed their responses. However, all subjects stated that they "knew" they had to step in to avoid disaster; therefore, intuitive factors were driving their actions.
- The data showed that there was a particular point in which each research subject intervened. The data further showed that this intervention usually occurred at a particular point in time that was crucial to a favorable outcome, a tipping point of sorts.

(3) Program Managers have little influence over minor decisions, but they can have great influence over major programmatic decisions

- The data suggests that program managers have very limited control over the decisions they make. The research subjects do not make the larger decisions, like what kind of products to procure, and when and how to procure. As stated above, those decisions occur at a different level and shaped by outside factors like the NDAA, requirements documents, and stakeholder/ congressional influence. However, that is not the end of the story.
- The data did show that program managers do possess something invaluable; influence over decision outcomes. This ability transcends the routine decisions they make on how to execute their program. The subjects had tremendous involvement with their vendors on their progress. They made routine decisions that included setting up testing events, programmatic

reviews, deciding when to go to their program executive officer when they are having issues.

B. FINDINGS AND THEORIES

There are two findings/theories gleaned from the research data.

1. Finding 1

Interference hinders decision-making.

2. Theory 1

Interference creates problems for program managers, and that interference can come from all sides. That interference comes in many different forms, whether it is in the form of threat to the troops, technology changes, weather, leadership changes, etc. All three-research subjects discussed these challenges. The most important decisions require external decision-makers; this is the point where changes could occur.

All three subjects suggested that it is necessary to decentralize the decision-making process so that they have more authority. For example, one of the research subjects had a capability with an Army-dictated due date. That acquisition strategy did not work for a multitude of reasons, including funding, contractual issues and emerging technology. The program manager knew problems existed, but Subject #3 did not have the authority to alter the path forward. The program office eventually obtained the permission necessary to scrap the old acquisition strategy for a different one after several years and multitudes of meetings later.

In deciding to end the acquisition strategy, the program office ran into another problem, the Pentagon bottleneck. It took months to calendar and brief the Service Acquisition Executive on their decision. They had to prepare for the meeting, write the brief and then travel to the meeting. Leadership scrapped the acquisition strategy under the suggestion of the program manager due to the explicit and tacit knowledge of the program manager. The outcome reaffirmed the program manager's initial recommendation for a decision and wasted many months of time. If program managers obtain more authority,

then they do not need to prepare for, travel to and then attend the meeting. They will have the authority to make that decision themselves. They will have more time to execute, which is what they want to do in the first place.

3. Finding 2

The acquisition process is tailorable, but not quite as agile as it needs to be.

4. Theory 2

All of the research subjects mentioned lack of agility in the acquisition process leads to failures, which particularly true considering the technology boom that has occurred over the last 10–15 years. These program managers (as well as one of the researchers) are (was) all in the radio business, and have domain over capabilities that directly evolved from the cancelled Joint Program Executive Office (JPEO), Joint Tactical Radio System (JTRS). The Army Acquisition Executive, the delegated Administrative Authority for JPEO JTRS, returned four ACAT 1D programs to the Army and one ACAT 1D program to the Navy.

As one researcher witnessed firsthand, JPEO JTRS had issues with massive congressional budget cuts, a decentralized management structure, requirements creep, and unexpected technical difficulties adding the required waveforms to their products. Further, it was ridiculously unpopular with military and civilian professionals at the Pentagon. All three of the pillars of cost, schedule and performance failed. The research subjects are acutely aware of the problems that existed in the past.

An agile system would not produce problems of this magnitude. The research subjects mentioned this time-and-time again. Building flexibility back into the DOD acquisition process needs to occur. Program managers need the ability to make greater decisions. This would leverage the explicit and tacit knowledge of the program managers.

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VI. CONCLUSION

This research identifies a small sample of the decision-making processes of Army program managers. The results from this research will be included in a larger data set currently in progress as previously discussed.

A. SUMMARY OF RESEARCH

The findings suggest that sensemaking, experience, and trust, as well as the lack of agility in the DOD's acquisition process, are very important inputs that shape the program managers' decision-making processes. Further research is required.

B. RECOMMENDATION

Continued research should occur regarding the four factors listed above on decision-making by program managers. This research will help more people, and not just current DOD acquisition professionals, understand how to better tailor the acquisition process and become more agile, fill capability gaps, and reduce overall costs.

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LIST OF REFERENCES

Ancona, D. (2011, September). *Sensemaking. Framing and acting in the unknown*. SAGE. https://www.sagepub.com/sites/default/files/upm-binaries/42924_1.pdf

Aung, J., & Norman, A. (n.d.). *Dual process theory—Explanation and examples*. Conceptually. Retrieved December 1, 2020, from https://conceptually.org/concepts/dual-processing-theory

Benjamin, B., & Baker, J. (2018, December). *How does a program manager gain insight in the complex and chaotic decision-making process* [Joint Applied Project Report, Naval Postgraduate School]? NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/61312

Barry, C. B. (1995). The Federal Acquisition Reform Act of 1994. *The Defense Institute of Security Assistance Management Journal*, *17*(3), 124–130. https://apps.dtic.mil/dtic/tr/fulltext/u2/a496621.pdf

Brown, B. (2010, August). *Introduction to Defense Acquisition Management*. Defense Acquisition University. https://apps.dtic.mil/dtic/tr/fulltext/u2/a606328.pdf

Christensen, D. S., Searle, D. A., & Vickery, C. (1999). The impact of the Packard commission's recommendations on reducing cost overruns on defense acquisition contracts. *Acquisition Review Quarterly, Summer 1999*, 251–262. Defense Technical Information Center. https://apps.dtic.mil/dtic/tr/fulltext/u2/a372859.pdf

Cooley, W., &. Ruhm, B. (2014, December). *A guide for DOD program managers*. Defense Acquisition University. https://acqnotes.com/wp-content/uploads/2014/09/A-Guide-for-DOD-Program-Managers.pdf

Department of Defense. (n.d.). *Better buying power* [Fact sheet]. Retrieved August 1, 2020, from https://www.ustranscom.mil/dbw/docs/BBP_Fact_Sheet.pdf

Donahue, J., Duong, T., & Ameh, F. (2018, December). *Why do programs fail? An analysis of defense program manager decision making in complex and chaotic program environments* [MBA Professional Project, Naval Postgraduate School]. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/61352

Embrey, D. (n.d.). *The skill, rule, and knowledge based classification.* Retrieved November 28, 2020, from http://www.humanreliability.com/downloads/Understanding-Human-Behaviour-and-Error.pdf

Fox, J. R. (2011, October 31). *Defense Acquisition reform*, *1960–2009: An elusive goal*. https://history.army.mil/html/books/051/51-3-1/CMH_Pub_51-3-1.pdf

Gioia, D., Corley, K., & Hamilton, A. (2012, July 24). Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology. *Sage Publications,* https://journals.sagepub.com/doi/abs/10.1177/1094428112452151

Gioia, D., & Pitre, E. (1990). Multiparadigm perspectives on theory building. *Academy of Management Review*, *15*(4), 584–602. https://doi.org/10.5465/amr.1990.4310758

Glaser, B (2021). *What is grounded theory?* Grounded Theory Institute. http://www.groundedtheory.com/what-is-gt.aspx

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research.* http://www.sxf.uevora.pt/wp-content/uploads/2013/03/Glaser_1967.pdf

Haas, K., & Lindbergh, L. (2010, October 12). *The bottom line on project complexity: applying a new complexity model*. Project Management Institute. https://www.pmi.org/learning/library/project-complexity-model-competency-standard-6586

Hoffman, R. (2015). *Accomplishments of naturalistic decision making research and applications to emerging defense challenges*. Florida Institute for Human and Machine Cognition. https://apps.dtic.mil/dtic/tr/fulltext/u2/a622061.pdf

Holcomb, J. & Rumfelt, A. (2018, December). *Building the decision-making environment in the information age: An analysis of defense program manager decision-making in complex and chaotic program environments* [Master's thesis, Naval Postgraduate School]. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/61385

Hollingworth, C., & Barker, L. (2019, August 7) *New frontiers: Re-establishing system1/ system2 truths*. Research Live. https://www.research-live.com/article/opinion/new-frontiers-reestablishing-system1system-2-truths/id/5057422

Jones, R. (2017, December). *Why do programs fail? An analysis of defense program manager decision making in complex and chaotic program environments* (NPS Report Number NPS-AM-18-20) [Acquisition Research Symposium, Naval Postgraduate School]. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/58820

Jones, R. (2020). *Why do programs fail? An analysis of defense program manager decision making in complex and chaotic program environments* (T20-007). Naval Postgraduate School. https://nps.edu/documents/105938399/109269809/2020+ARP+Student+Topics+List+as+of+05-21-2020.pdf/d7e8a667-f424-200f-0ddc-4c6039e03223?t=1596222059193

Kahneman, D. (2003). A perspective on judgement and choice: Mapping bounded rationality. *American Psychologist*, *58*(9), 697–720. https://doi.org/10.1037/0003-066X.58.9.697

Kahneman, D. (2012, June 15). Of 2 minds: How fast and slow thinking shape perception and choice [Excerpt]. *Scientific American*. https://www.scientificamerican.com/article/kahneman-excerpt-thinking-fast-and-slow/

Kauer, D. (2008). *The Effect of Managerial Experiences on Strategic Sensemaking* (1st ed. 2008). Gabler Verlag. https://doi.ord/10-1007/978-3-8349-9632-9

Klein, G., Orasanu, J., Calderwood, R., & Zsambok, C. E. (1993). *Decision making in action: Models and methods.* http://www.macrocognition.com/documents/Decision-Making-in-Action-Models-and-Methods-0316.pdf

Klein, G. (2008). Naturalistic decision making. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *50*(3), 456–460. https://doi.org/10.1518/001872008X288385

Klein, G. (2015). A naturalistic decision making perspective on studying intuitive decision-making. *Journal of Applied Research in Memory and Cognition*, *4*(3), 164–168.

Layton, E. (2007). *The Defense Acquisition University: Training professionals for the acquisition workforce 1992–2003*. https://www.dau.edu/about/Documents/DAU%20History%20Book.pdf

Matzler, K., Bailom, F., & Mooradian, T. (2007, October 1). Intuitive decision making. *MITSloan Management Review*. https://sloanreview.mit.edu/article/intuitive-decision-making/

McInnis, K. J. (2016). *Goldwater-Nichols at 30: Defense reform and issues for congress* (CRS Report No. R44474). Congressional Research Service. https://fas.org/sgp/crs/natsec/R44474.pdf

National Defense Industrial Association. (2019, June 11). *GAO publishes recommendations on effectively implementing changes for acquisition reform*. https://www.ndia.org/policy/recent-posts/2019/6/11/gao-publishes-recommendations-on-effectively-implementing-changes-for-acquisition-reform

Neterer, J., & Patrone, M. (2018, December). *Why do programs fail? An analysis of defense program manager decision-making in complex and chaotic program environments* [MBA Professional Project, Naval Postgraduate School]. NPS Archive: Calhoun. https://calhoun.nps.edu/handle/10945/61231

Nickerson, R. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology 2*(2), 175–220. http://psy2.ucsd.edu/~mckenzie/nickersonConfirmationBias.pdf

Oakley, S. (2020, June). *Defense acquisitions annual assessment: Drive to delivery capabilities faster increases importance of program knowledge and consistent data for oversight* (GAO-20-439). Government Accountability Office. https://www.gao.gov/assets/gao-20-439.pdf

Paull, M., Boudville, I., & Sitlington, H. (2013). Using sensemaking as a diagnostic tool in the analysis of qualitative data. *The Qualitative Report, 18*(27), 1–12. https://nsuworks.nova.edu/cgi/viewcontent.cgi?article=1496&context=tqr

Rasmussen, J. (1983). *Skills, rules, and knowledge; Signals, signs, and symbols, and other distinctions in human performance models*. https://www.iwolm.com/wp-content/downloads/SkillsRulesAndKnowledge-Rasmussen.pdf

Snowden, D., & Boone, M.E. (2007, November). *A leader's framework for decision making.* Harvard Business Review. https://hbr.org/2007/11/a-leaders-framework-for-decision-making

Sullivan, M. (2012, December 14). *Weapons acquisition reform: Reform act is helping DOD acquisition programs reduce risk, but implementation challenges remain* (GAO-13-103). Government Accountability Office. https://www.gao.gov/products/GAO-13-103

U.S. Department of Defense. (n.d.). *Our story*. Retrieved August 1, 2020, from https://www.defense.gov/our-story

Warren, D. R. (1999, April 21). *Defense reform initiative: Organization, status, and challenges* (GAO/NSAID-99-87). Government Accountability Office. https://www.gao.gov/assets/160/156598.pdf

Wolf, R. F. (2012). *How to minimize your biases when making decisions*. Harvard Business Review. https://hbr.org/2012/09/how-to-minimize-your-biases-when

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